In the Mood for Creativity: Exploring Exposure to Humor and Creative Output

by

Sarah Lee

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Sarah Lee

Department of Psychology

The University of Texas at Arlington

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Supervising Professor: Jared Kenworthy

Abstract

The purpose of these three studies was to replicate prior findings, namely, that positive moods can improve creative performance (Baas et al., 2008) as well as to test whether humor provides a creative advantage relative to a neutral emotional state. Three studies were conducted using sets of ten memes as the mood induction stimuli. Participants were assigned to either a positive, humor, or neutral condition in study one. Study two added an irony condition and study three added four parallel explanation conditions (i.e., positive explain, humor explain, neutral explain, irony explain). Participants were assigned to either a positive, humor, neutral, or ironic condition. It was expected that those in the positive and humor conditions would perform better on divergent creativity tasks compared to those in the neutral condition, and that the humor condition would perform better than the positive condition. It was additionally anticipated that those in the ironic condition would perform better on both divergent and convergent tasks compared to those in the neutral condition. Personality traits typically related to creativity such as openness, extraversion, and conscientiousness were also examined, but unfortunately did not replicate. Only support for positive mood enhancing creative fluency was found (studies one and two). Implications and future directions are discussed.

Keywords: affect, positive mood, creativity, humor

In the Mood for Creativity: Exploring Exposure to Humor and Creative Output

Creativity is arguably one of the most important constructs in the field of psychology. Creative thinking allows us to solve problems, adapt effectively to new circumstances, navigate our complex social world, and most importantly, survive.

New obstacles that require creative solutions arise every day. If an individual or company is unwilling to or cannot adapt to these changes, they will be replaced by another who will. Modern businesses are challenged to be more profitable by offering better products or services with fewer people at a competitive cost (Hair et al., 2013). Therefore, the success of many corporations depends on the ability to not only adapt to new societal, cultural, and technological changes over time but to do so within constraints (Kaufman & Sternberg, 2019).

One way to open the mind to more innovative solutions is with a positive mood. There are several studies that show positive mood is beneficial to creative performance (Baas et al., 2008; Estrada et al., 1994; Isen et al., 1987; Isen, Daubman, & Nowicki, 1987; Isen et al., 2004; Kaufman, 2016). Both trait- and state-level positive affect can augment creative and problem-solving ability, likely through broadened cognitive processes and associations (Feist, 2019; Fredrickson, 2001). Amabile and colleagues (2005) even advocated that positive affect should be incorporated into how people think about creativity.

To induce positive affect, many use a comedy film, but positive affect represents a spectrum of emotions rather than a single unifying representation (Filipowicz, 2006). Positive moods can be deactivating as in relaxation, or activating as in the case of happiness or elation (Baas et al., 2008). Another popular means of affect induction is a free gift (e.g., candy, extra credit; Isen et al., 1987). However, various methods of positive affect induction are not compared

to each other, and methodologically, any attempt to differentiate between humor and other forms of positive affect on creative performance is not possible.

Humor and laughter represent universal and fundamental human experiences that do increase positive affect, but the positive feelings of amusement relayed through humor is a distinct emotion worthy of its own investigation (Apte, 1985; Lefcourt, 2001; Martin & Ford, 2018; Szabo, 2003); However, there is no known study that induces positive affect with humor and compares creativity scores to another general positive affect condition, in addition to a neutral control, nor one which incorporates irony into the design.

Experiment two of Isen and colleagues (1987) found more participants who watched a five-minute comedy video solved the Duncker Candle Problem compared to those who watched a neutral video (i.e., five-minute math tutorial), received a free gift (i.e., small junior candy bar; general positive affect), exercised for two-minutes, or were not exposed to any manipulation. These researchers suggest that humor may be unique but did not test this idea further in future research by comparing a successful, positive affect induction to a comedy video. Therefore, multiple studies indirectly test the humor-creativity relationship, but none actively differentiate between whether various facets of positive affect provide a creative advantage over another. This dissertation aims to address this gap in the literature, as well as other nuanced questions about the humor-creativity relationship.

Humor can help deepen relationships, facilitate communication, establish parameters, diffuse tension, and improve the mood of group members during business meetings (Consalvo, 1989; Janes & Olson, 2015; Martineau, 1972). Humor also can help a negotiation become more equitable – just sending one funny email can increase feelings of trust in the sender and satisfaction with an outcome (Kurtzberg et al., 2009). Further, positive humor displayed by a

supervisor can increase employee job satisfaction and commitment to an organization (Decker, 1987; Hughes & Avey, 2009).

About 60% of corporate executives state that creativity is their highest priority and the most valuable trait a leader can have (IBM, 2018; Roberto, 2019). Transformational leaders – those that instill confidence in their employees, motivate initiative, and encourage employee creativity – are likely to have higher creative self-efficacy themselves, and tend to have subordinates who are more creatively engaged (Gong, et al., 2009; Huang et al., 2016). An underestimated contributor to the highly valued creative ability may be humor – a humorous atmosphere is said to encourage inventiveness and inspire novel ideas (Chen et al., 2018).

If humor and creativity share similar underlying elements, then incorporating more humor into the workplace can potentially help improve interpersonal relationships, foster a safe space to share new ideas, as well as spark new ideas beneficial to one's work as well as the company's goals.

The aim of this dissertation project is to examine creative performance by separating positive affect from various forms of humor. I anticipate differences in creative performance based on participants' exposure to positive, humorous, and ironic stimuli relative to neutral stimuli, as well as to each other. I also assess the role of Big-Five personality traits, and further, I examine whether deliberate explanations of each mood induction category changes creative performance. I designed and conducted a series of three studies to test these ideas.

The Constructs of Creativity and Humor

Both creativity and humor are expansive constructs that elude a comprehensive and universally accepted definition. This makes them both difficult to operationalize (Humke & Schaefer, 1996; Kaufman et al., 2008; Murdock & Ganim, 1993; Ruch, 1998). Therefore, this

section will present a general introduction to both concepts and their relation to the current research.

Creativity

The following subsection will provide a general overview of creativity: what it is, how it fits into daily life, and the ways in which it is typically measured in the laboratory.

Contrary to popular belief, an individual's creative capacity is not inherited and fixed (Kaufman & Sternberg, 2019). A central component of creativity is a mindset that favors thinking in novel, surprising, and compelling ways – and this mindset can be taught (Sternberg, 2019).

According to Runco and Jaeger (2012), the first standard definition of creativity (which continues to be used today) involves that which is novel *and* accepted as useful or task-appropriate (Amabile, 1983; Hennessey & Amabile, 2010; Kaufman & Glăveanu, 2019; Stein, 1953). Originality, or "novelty," is essential for creativity, but it is inadequate on its own. A novel product is only creative if it is also task-relevant (Simonton, 2012). Stated differently, creativity is "the mental capacity and tendency to generate new ideas and products that have some purpose, utility, or worth" (Ward & Kolomyts, 2019, pp. 175). However, while requiring a creative idea or product to be both new and useful specifies some constraint, what qualifies to fit into this definition is nonetheless incalculable. This makes both measuring creativity and drawing conclusions from those measurements challenging.

As such, the concept of creativity is extensive and at times subjective. Further, not all exemplifications of creativity are equal (Ward & Kolomyts, 2019). Researchers categorize levels of individual creativity through what they call the four C's: mini-c, little-c, Pro-c, and Big-C creativity (Beghetto & Kaufman, 2007; Kaufman & Beghetto, 2009; Simonton, 2013b).

A mini-c idea or product is only required to be novel and useful to the person who created it and no one else (e.g., someone attempting to write a short story for the first time). Little-c reflects creative expression that expands beyond personal tinkering and enters into a more practiced, public space. Here the individual is actively exploring and experimenting within their new domain, but still lacks a formal mentor. For example, someone who practices short-story writing may begin posting those stories on a website where others can provide feedback or may simply continue practicing out of sheer enjoyment. Pro-c describes professional creatives who are not yet deemed "eminent." These are individuals who may make a career out of their creative talent such as well-published authors (e.g., Agatha Christie, James Patterson, Nicholas Sparks), but who have not reached the eminent status of Big-C creators that are remembered and celebrated for their creations and contributions for years (e.g., Jane Austen, Charles Dickens, George Orwell).

"Everyday creativity" extends from mini-c to Pro-c, however "eminent creativity" only describes those whose talents reside in the Big-C category (Kaufman & Beghetto, 2009). Researchers ask participants to exercise little-c creativity when they administer a creativity task in the lab and employees exercise little-c creativity when asked to generate ideas in the workplace. Laboratory tasks are further classified as measuring either divergent (DT) and/or convergent (CT) creativity (Guilford, 1950, 1967).

Guilford's (1950; 1956; 1968) Structure of Intellect (SOI) model first distinguished between DT and CT (Runco & Acar, 2019). DT involves making connections and assembling unique associations (Kaufman et al., 2008). Laboratory tasks measuring DT usually ask the participant to produce as many ideas or solutions to a problem as possible in response to an open-ended prompt (Guilford, 1950; 1967; 1968; Simonton, 2003). Stated differently,

"Divergent thinking is cognition that leads in various directions," (Runco, 1999, p. 577). This construct is the basis of most creativity tests in the laboratory (Kaufman & Glăveanu, 2019). For example, a common DT task is asking participants to list as many uses as they can for a brick (Friedman & Förster, 2001; Torrance, 1962).

The three most commonly mentioned aspects of DT are fluency, originality, and flexibility (Guilford, 1968; Rose, 2011; Runco, 1999). Fluency is the number of unique, non-repetitive, relevant ideas generated (e.g., generating many distinct uses for a brick); originality is how rare or novel each individual idea is (e.g., generating uses that are statistically less common relative to the current sample); and flexibility is the diversity of categories in which the generated ideas belong (e.g., using the brick to build something vs. as something that is heavy vs. as a pet). Another aspect less often mentioned is elaboration, which is how extended and developed each generated idea is (e.g., painting the brick with glow in the dark paint and then using it as a nightlight vs. to hit someone).

Often at a later stage of the creative ideation process, a CT task requests the participant to provide a single (or optimal) solution to a problem. One such task commonly used in research studies is the Duncker (1945) candle problem. In this problem, participants are told to attach a candle to the wall so that when the candle is lit the wax does not drip onto the surface below. Participants are presented with only a box of thumb tacks and a book of matches. The solution is to use the box of tacks to support the candle on the wall. Bypassing functional fixedness by restructuring how one thinks about the box of tacks is necessary to solve this problem and will often occur suddenly (Baas et al., 2008). Whereas DT emphasizes various directions of thought, CT emphasizes a single solution (or very few; Runco & Acar, 2019).

Moreover, the creative process is said to lie on a cognitive continuum (Eysenck, 2003; Kaufman et al., 2008; Runco, 2007). Related to creativity are innovation and, modestly, intelligence. Innovation extends the creative process further by finding a way to implement the best novel ideas (West, 2002; West et al., 2004), while intelligence concerns the comprehension of complex problems, ability to learn, and intellectual capability to think of ideas (Kim et al., 2010; Neisser, 1996; Sternberg, 2019). This dissertation does not incorporate either innovation or intelligence, but the reader should note that these constructs are also influential to the creative process.

Humor

As in the creativity section the following subsection will provide a general overview of humor: what it is, how it fits into daily life, and the ways in which it is typically measured in the laboratory.

Put in deceptively simple terms, humor is anything that might make someone laugh. However, humor is multifaceted and complex with cognitive, behavioral, emotional, and social influences. Martin and Ford (2018) offer the following definition: "Humor is a broad, multifaceted term that represents anything that people say or do that others perceive as funny and tends to make them laugh, as well as the mental processes that go into both creating and perceiving such an amusing stimulus, and also the emotional response of mirth involved in the enjoyment of it" (p. 3). Therefore, humor involves more than the cognitive ability to perceive it. There is the social context of the stimulus, as well as an emotional (i.e., mirth) and behavioral (i.e., laughter) response.

A non-exhaustive list of types of humor include jokes, witticisms, and forms of irony (e.g., sarcasm, parody). A joke is told with the specific purpose of making someone laugh; it is

told with intention. Jokes are characterized with a punchline, which appears at the end of the joke and is what makes it funny. Wit is something funny in the context of a certain situation (Earleywine, 2011); it is related to sarcasm and tends to be a more intellectually-based form of humor (Martin & Ford, 2018). Irony is when a situation or statement describes or says the opposite to what was expected or intended (Preminger et al., 1974), such as a positive statement with a negative meaning. Sarcasm is an aggressive form of verbal irony that has pointed mocking and contemptuous intentions (Kreuz & Glucksberg, 1989). Many researchers consider irony and sarcasm to be strongly related and use the terms interchangeably (Attardo, 2007; Liebrecht et al., 2013; Martin & Ford, 2018). As this paper concerns mainly positive emotionality, it will focus on irony in an attempt to minimize the extraneous influences of negative emotionality brought about by sarcasm in particular.

There are a few ways in which humor can be expressed. The main categories within the literature involve humor production, comprehension, and appreciation, with work on humor appreciation being the most plentiful. Humor production concerns one's ability to generate humor that induces a mirth response in others. Humor comprehension refers to the cognitive processes involved in "getting" a joke; understanding humor often requires language processing, reasoning, mental flexibility, working memory, and problem-solving skills (Geher & Miller, 2008; Shammi & Stuss, 2003; Shultz, 1972; Suls, 1972). Humor appreciation is simply the experience of finding something amusing (operationalized by smiling, laughing, and subjective ratings). This paper mainly concerns humor appreciation, with humor comprehension of secondary interest; humor styles are also incorporated, but only on an exploratory basis.

The Humor Styles Questionnaire (HSQ; Martin et al., 2003) is typically given to determine how people use humor in their everyday life. Participants are categorized into using

either self-enhancing, affiliative, aggressive, or self-defeating forms of humor. A self-enhancing style focuses on the self and can be characterized by someone who tries to improve their mood with humor when stressed or facing a difficult situation or circumstance (Kuiper, Martin, & Olinger, 1993). An example item from this subscale reads, "If I am feeling depressed, I can usually cheer myself up with humor." Someone who uses an affiliative style is more other-focused and uses humor mostly to enhance their social interactions with funny stories and light-hearted non-aggressive jokes. An example item reads, "I enjoy making people laugh." Aggressive humor is designed to belittle, exclude, or overpower another person or group. Jokes made by someone with an aggressive style will most likely include elements of criticism, irony, teasing, and sarcasm (Kocak, 2018; Lussier et al., 2017). An example item from this subscale reads, "If I don't like someone, I often use humor or teasing to put them down." Lastly, a person who uses a self-defeating style will belittle themselves as a way to entertain and gain approval from others (Kocak, 2018). An example item reads, "I often go overboard in putting myself down when I am making jokes or trying to be funny."

Cartoons have been enjoyed in U.S. Sunday newspapers since 1895 and continue to be enjoyed today, indeed branching over to social media platforms such as Instagram (e.g., Catana Comics, Cyanide & Happiness, Strange Planet; Bellis, 2020). Because of their familiarity and effectiveness, researchers even use cartoons as a form of experimental mood induction (Akben & Coskun, 2018), as well as a behavioral measure of humor ability, such as with variations of the Cartoon Punch Line Production Test (CPPT; Köhler & Ruch, 1993, 1996). In the CPPT participants are given a set of cartoons and are told to provide the most humorous caption they can for each. These captions (i.e., punchlines) are then rated by judges for how funny they are.

Related to cartoons as a form of entertainment, an outlet for creativity, and a source of humor, are internet memes. Richard Dawkins (1976) coined the term 'meme' by shortening the Greek word 'Mimeme' (meaning 'that which is imitated') so that it was more similar to the word 'gene.' He describes a meme as a unit of cultural information that circulates among people by replication or imitation. "Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation," (Dawkins, 1976, p. 192). However, as his writing pre-dates the internet, his examples of memes were tunes, ideas, and catchphrases. Internet memes are therefore described as such due to their ability to thrive off of replicating an original image and modifying it for a new situation.

Internet memes are ephemeral, attention-grabbing images that are shared among friends for a laugh, to initiate emotional experiences, and enhance social connection (Denisova, 2019). This dissertation uses memes as a form of experimental mood induction because of their prominent role in modern social communication, anecdotal ability to induce laughter, and because as of yet very few researchers have implemented this form of stimuli into their designs.

Theoretical Basis

For over 50 years researchers interested in both humor and creativity have conducted studies on the relationship; however, there are no known theories that integrate both variables. For this reason, theories explaining each construct will be discussed separately in the following sections.

Theories of Creativity

There is agreement within the literature that creativity is defined as something which is both new and useful (Hennessey & Amabile, 2010; Kaufman & Glăveanu, 2019; Simonton,

2012). But the field of creativity is vastly complex, and as a result there is no accepted grand theory of creativity that incorporates every facet within it (nor would that be particularly useful; Baer, 2011). Instead, there are many demarcated creativity theories that address various constituents and domain-specific elements of the construct. The following section will describe a few select theories within the field of creativity that relate specifically to positive affect and the focus of this paper.

While affect, mood, and emotion are often used interchangeably in the literature (such as in this paper; see also Baas et al., 2008; Baas, 2019), they are not the same and the reader should be aware of their differences. Affect is an umbrella term used to describe a subjective feeling; both mood and emotion are subtypes of affect and are different from each other. Emotions are typically directed at or are the result of a specific stimulus (e.g., person, object, event) and are thus more consciously articulated and experienced. Moods do not necessarily have to be clearly caused by or directed at any one stimulus. They tend to be longer lasting and of less intensity compared to emotions (Frijda, 1993). For example, "grumpy" is classified as a general mood, but "angry" is classified as a specific emotion resulting from a specific event.

Baas and colleagues (2008) conducted a meta-analysis of the relationship between mood and creativity. They describe the relationship as an interaction of hedonic tone, activation, and regulatory focus. Positive moods such as happiness and excitement are said to increase creative thought because they signal a safe environment, increase spreading activation of semantic networks, and increase cognitive flexibility (Isen, 2000; Fielder, 2000). Activation concerns the level of arousal that one is experiencing. Moderate levels of arousal facilitate creativity because individuals are motivated but not overwhelmed. This leads to a greater ability to integrate information and increase cognitive flexibility (Brehm, 1999; Carver, 2004; De Dreu et al., 2008).

Regulatory focus (Friedman & Förster, 2001; Higgins, 2006) refers to whether individuals are promotion or prevention focused in regard to their desired end states. Promotion states are said to stimulate more creative thought than are prevention states because the former broadens attentional focus and arouses a more extensive semantic network less hindered by topics that may have primed the mind to think in a certain direction.

The Broaden-and-Build Theory (Fredrickson, 1998; 2001) contends that experiencing positive affect (e.g., joy, interest, amusement, contentment, pride, gratitude, love) has more of a function than merely increasing happiness – these emotions also allow people to broaden their mental horizons, permitting creative thought to flow. Whereas negative emotions narrow focus of attention and actions, positive emotions broaden them. Through a positive feedback loop, positive emotions are produced more often, beneficial outcomes are observed (i.e., increased knowledge, improved skills, enhanced social networks), and the cycle perpetuates. Stated differently, this theory posits that by experiencing positive emotions (e.g., cheerfulness, amusement) one may momentarily broaden their thought-action repertoires, thereby building physical, intellectual, and social resources which allow them to better endure life's challenges and leads to more positive emotions.

The research on mood and creativity itself is extensive (Baas et al., 2008; Davis, 2009), but in general, the patterns suggest that mood states which activate the individual (e.g., happiness, anger, fear) promote creativity (Baas, 2019). Activation is beneficial to creativity because it serves to increase motivational engagement, sustained attention, and effort in goal-related activities (Baas, et al., 2011; Posner, et al., 2005).

Meta-analytic studies confirm that a happy mood is associated with enhanced creative performance (Baas et al., 2008; Davis, 2009; Lyubomirsky et al., 2005). In fact, happiness is the

most robust mood predictor of creativity in both experimental and field studies (Baas, 2019; Conner & Silvia, 2015; De Dreu et al., 2008; Hirt et al., 2008; Madrid et al., 2014; To et al., 2015). Unfortunately, many affect studies in the creativity literature use humor as the mechanism by which the participant migrates into a positive mood, making it difficult to differentiate from other activating and positive emotions (e.g., cheerfulness).

Theories of Humor

Scholars, philosophers, psychologists, and linguists have all long wondered what exactly makes something funny. As a result, these intellectuals have come up with a variety of theoretical explanations. This section will briefly explain only a few of these theories.

Incongruity theories maintain that humor and laughter result from the identification of a discrepancy or incongruity. Koestler (1964) coined the term "bisociation" to describe the ability to simultaneously hold two contradictory interpretations for a situation or event, which, according to this group of theories, is at the center of the humor experience. However, incongruity on its own, while necessary, is not sufficient by itself to produce humor. Researchers have since elaborated upon Koestler's bisociation idea, further proposing that the incongruity must be resolved (i.e., "make sense") as well as be interpreted using a "humor mindset" (i.e., a playful/nonserious mindset; Berlyne, 1972).

Incongruity-resolution theory (Shultz, 1972) claims the punch line of a joke is what creates the incongruity. The recipient of the joke, upon hearing the punchline, is prompted to revisit the joke setup where they need to identify the ambiguity there, and then tie that ambiguity back to the punch line where then the joke makes sense – one "gets the joke" – and humor is experienced. The following presents an example from Dai and colleagues (2017): 'Teacher: Why

are you late? Student: There was a man who lost a 100-dollar bill. Teacher: I see. Were you trying to help him look for it? Student: No. I was standing on it.'

The two-stage model of humor appreciation (Suls, 1972; 1983) conceptualized humor comprehension as a problem-solving task where laughter results from reconciling an unexpected incongruity. The joke setup prompts the recipient to construct a prediction about the outcome. When the punchline does not match the prediction, the recipient is surprised, which then motivates them to search for a cognitive rule that will coincide the punch line with the joke setup. Once that cognitive rule is detected, the incongruity is resolved, and humor is experienced.

Similar to incongruity theory, the General Theory of Humor states the foundation to a successful joke is to have two simultaneously incompatible meanings (Attardo, 2008; Attardo & Raskin, 1991). A funny punch line reveals something surprising – an assumption that was maintained throughout the joke but was broken at the end. This theory suggests humor arises from the incongruity of this assumption, making us realize we were wrong all along (Aristotle, 1941; Earleywine, 2011).

Experimental research does generally support the idea that incongruity underlies humor. The pattern of findings suggests that incongruity without resolution is funnier than no incongruity, but incongruity that is resolved is the funniest (Shultz, 1972; 1974; Shultz & Horibe, 1974). However, incongruity theories do not underlie all humor and as such, do not provide an all-encompassing explanation; they also do not incorporate social context (Martin & Ford, 2018).

Contemporary Theories. The three contemporary theories of humor include reversal theory, comprehension-elaboration theory, and benign violation theory. They approach humor from a more individualized and subjective perspective, acknowledging that the perception of humor will differ among people. In this way, rather than focusing on properties of the humor

experience itself, these contemporary perspectives instead attempt to understand the psychological processes of humor.

Reversal Theory (RT; Apter, 1982) first asserts that people alternate between a telic (serious, practical) and paratelic (playful, spontaneous) mindset, and that arousal is experienced differently depending on which mindset one is currently in. High arousal in a telic state would be experienced as anxiety, but in a paratelic state as excitement or fun, whereas low arousal in a telic state would be experienced as relaxation, but in a paratelic state as boredom (similar to hedonic tone; Baas et al., 2008). According to this theory humor is said to increase arousal, and this arousal is perceived as fun and exciting because humor is considered a paratelic activity that contains cues within the humor stimulus itself or social context that indicate one should switch into a paratelic state if they are not in one already – but this mental switch is not sufficient. RT also contends that cognitive synergy and diminishment is essential to perceive humor. Cognitive synergy (Apter, 2013) is the ability to cognitively hold two contradictory interpretations simultaneously (e.g., intelligent/stupid) and diminishment occurs when one realizes something is less consequential than originally thought. Therefore, to perceive something as humorous one must be in a paratelic state coupled with heightened arousal. The individual must also experience cognitive synergy where the humorous instance provides two interpretations, the second of which results in diminishment of the first.

Comprehension-Elaboration Theory (CET; Wyer & Collins, 1992) is similar to reversal theory in that it too requires a reinterpretation that results in diminishment, but here the diminishment must specifically be in the form of trivialization. CET maintains the amount of humor one experiences is a function of the degree of diminishment from the first to second interpretation, the type (i.e., humor- relevant vs. irrelevant) and quantity of cognitive elaboration

that occurs in response to that second interpretation, as well as the level of difficulty required in comprehending the humor. Here, comprehension refers to the initial understanding of the humor and elaboration refers to the manner and extent to which people expand upon the reinterpretation. Less amusement is expected from a joke with low elaboration potential, but more amusement is expected from events that are moderately difficult to understand or are paratelic-motivated humor-relevant elaborations (Martin & Ford, 2018).

Benign Violation Theory (BVT; McGraw & Warren, 2010; McGraw et al., 2012; Warren & McGraw, 2015) provides a more general explanation for humor, but is similar to other theories centered around juxtaposition of contrasting concepts or events (e.g., Koestler, 1964; Shultz, 1972; Suls, 1972). It proposes that humor must be interpreted as a violation, this violation must be perceived as harmless, and the individual must hold these two construals simultaneously – meaning the humor is appraised as both a threat and benign at the same time. This violation is central to humor just as in other theories and is characterized by something that is perceived as threatening, wrong, or negative. According to BVT, all forms of humor can be reduced to a benign violation.

Creativity and Humor

By integrating the theories discussed earlier we can deduce that humor has the potential to influence creativity through cognitive, affective, behavioral, and social means (Koestler, 1964; Martin & Ford, 2018; Romero & Pescosolido, 2008; Wood et al., 2011). Empirical research generally supports this deduction but neglects to specify the boundaries by which humor affects creativity. This section will not attempt to identify these boundaries but will provide an overview of the research and reasoning for why humor is thought to relate to creativity.

Unique cognitive abilities such as creativity and humor evolved in humans likely as a characteristic valuable in sexual selection (Geher & Miller, 2008; Greengross & Miller, 2001; Kaufman et al., 2008). Indeed, Verweij and colleagues (2014) identified creativity as a sexually selected trait; wit, intelligence, charm, and creativity are all considered attractive attributes of a desirable mate (Miller, 2000). Exercising both humor and creativity may increase the odds of attracting a mate and may be why they share many similarities – humor and creativity are both vital skills that allow humans to respond to unexpected challenges and demonstrate adaptability.

Further, creativity and humor share the neurotransmitter oxytocin in common. Oxytocin is known for its role as the "love hormone," but it can also modulate feelings of trust. Laughter is one such trigger for the release of this neuropeptide, which may be why humor can facilitate team cohesion (Aaker & Bagdonas, 2021). On the creative side, oxytocin seems to promote cognitive flexibility (De Dreu et al., 2015).

Koestler (1964) described the fusion of previously incompatible concepts as "bisociation." Specifically, he said that a creative act should operate on more than one plane because it signifies a transitory double-minded state where the balance of emotion and thought are disturbed. Thinking conventionally is the result of mentally operating on a single plane but thinking creatively is the result of mentally operating on more than one plane. Bisociation is the junction between "two self-consistent but habitually incompatible frames of reference" (Koestler, 1964, p. 35). Although his theory centered on creativity in art and science, he drew some parallels between this creative process and various types of humor that are similar to those suggested by incongruity theory. For example, he states a pun is the bisociation of two meanings manifested in a single form and which is enjoyed. Therefore, the invention and comprehension of humorous content may share a certain degree of overlap with creative thinking.

Sometimes Incongruity Theory is called incongruity-resolution because it explains incongruity as surprise and resolution as fit (Wicker et al., 1981). Incongruity is often not easy to resolve. It is said to require "schema shifting" where people need to forgo using their familiar or superior schemas for novel or unique ones instead. This process is similar to that used in creative measurement tasks (Chen et al., 2018).

Construal Level Theory (Trope & Liberman, 2010) describes how psychological distance may relate to abstract thinking. A sarcastic statement expresses one meaning but actually indicates the opposite (Gibbs, 1986; 2000). If abstract thinking is involved in the process of deciphering the actual meaning of a joke and the humorous aspect of the joke, then creating and understanding a sarcastic statement requires the individual to carve out a new cognitive route in order to understand that joke – and if sarcasm facilitates abstract thinking, it may also facilitate creative thought. This is potentially true when both constructing a sarcastic statement and comprehending one. Indeed, the few studies examining sarcasm did find improved performance on a convergent task (Miron-Spektor et al., 2011; Huang et al., 2015; Smith & White, 1965).

Recalling that BVT requires humor to be the result of an event that is simultaneously threatening and benign, McGraw and colleagues (2012) anticipate more amusement from highly threatening events (e.g., tragedies) that traverse appropriate psychological distance to reach the benign interpretation. Their research suggests that events of misfortune are more amusing when psychologically close than distant; however, too small a distance and the interpretation remains too threatening, but too large and one may not perceive a violation at all. Ironic statements and events may walk this line of appropriate psychological distance and activation, thereby exercising the abstract thinking underlying creativity (Baas et al., 2008; Martin & Ford, 2018; McGraw et al., 2012).

Creative ability and humorous potential are skills. They are not fixed. Individuals who adopt a growth mindset can improve both of these abilities with training and practice (Aaker & Bagdonas, 2021; Dweck, 2006). Furthermore, improving one of these abilities may assist the other. For example, Kudrowitz (2010) found improvisational comedians produced not only a greater number of ideas for a product idea generation task, but ideas that were more creative than those of professional product designers.

Humor and creativity both involve shifting frames of reference, connecting seemingly unrelated elements together, and managing effective and appropriate surprise (Eliav et al., 2016; Filipowicz, 2006; Murdock & Ganim, 1993). Some researchers even argue that humor comprehension is in itself a cognitively creative process and the practice of understanding each humorous instance is like creativity training (Chen et al., 2018). To understand a joke, one often needs to shift mental schemas from those which are more dominant to those that are more original – or maybe even conflicting. This shifting mechanism may help creative thought by helping the individual view something from a different perspective. Basically, it seems both humor and creativity employ the ability to connect seemingly unrelated things. This process of discovering similarities between previous and novel situations uses analogical reasoning (Sternberg, 1977). Practicing abstract thinking can increase flexibility of category membership which can then increase cognitive flexibility, a hallmark of creative cognition (Vartanian, 2019).

Laughter, a more affectively driven response, is thought to diffuse anxious feelings that may otherwise inhibit creative thought processes (Chen et al., 2018). Appreciating a joke can improve one's mood leading to broadened thought-action repertoires (Fredrickson, 2001). Creative individuals often transform their work from an obligation to a hobby, increasing their internal motivation towards their efforts (Amabile, 1983). Likewise, understanding and enjoying

a good joke is pleasurable, and pleasurable activities are more likely to be repeated (i.e., increase internal motivation). Therefore, transforming one's work from an obligation to a hobby through humor can increase one's internal motivation toward a task, motivating one to continue learning, practicing, progressing, and developing one's creative skills. After all, Simonton (1977; 1985) concluded the composers and psychologists who wrote the most music or conducted the most studies, respectively, also produced the best. The more people can motivate themselves to continue harnessing their skills, the better they may end up being.

Different affective states are further thought to aid certain creative tasks better than others. The literature suggests that a negative mood leads to an analytic, bottom-up processing style conducive to convergent thinking tasks (Barth & Funke, 2010; Bless et al., 1996; Fielder, 2000). Feeling sad, for instance, can encourage people to rely on more logical and complicated strategies (Jausovec, 1989). Negative affect can arise from humorous situations such as if the recipient is offended, feels criticized, or if they feel they are being laughed at (Burma, 1946; Obrdlik, 1942; Stephenson, 1951). Therefore, experiencing a form of humor that is lightly offensive, slightly uncomfortable, or maybe even has a sarcastic tone to it may induce a narrower, more focused mindset conducive to analytic problem solving. Conversely, a positive mood is said to lead to a heuristic, top-down processing style (Barth & Funke, 2010). Positive moods that are activating (e.g., happiness) are especially more likely to show enhanced creative performance (Baas et al., 2008).

The relationship between humor styles and creativity is seen sparingly in the literature, but studies suggest that positive humor styles (i.e., affiliative, self-enhancing) are positively related to positive affect, while negative humor styles (i.e., aggressive, self-defeating) are negatively related to positive affect and positively related to negative affect (Chang et al., 2015;

Martin et al., 2003). Therefore, it may be that individuals with a positive humor style perform better on divergent creativity tasks, while those with negative humor styles perform better on convergent creativity tasks. Additionally, in a study by Chang and colleagues (2015), they used the HSQ to classify individuals as either a general humor endorser, a humor denier, a positive humor endorser, or a negative humor endorser, finding those who were general humor endorsers (i.e., those high in each humor style) performed better on a creative figure-drawing task compared to the other styles. The authors propose this may be because general humor endorsers hold opposing positive and negative humor appreciation and holding opposing elements is said to have beneficial effects on creativity (Barron & Harrington, 1981; Csikszentmihalyi, 1996; Huang, 2020).

"Humor can be dissected as a frog can, but the thing dies in the process and the innards are discouraging to any but the scientific mind," (White, 1941, p. xvii). It may be that the process of deciphering why a joke is funny can diminish amusement, but it could also provide a creative boost because of the use of abstract thinking used to understand that joke, thereby acting as a possible cognitive prime. Another aim of this dissertation was to investigate if drawing attention to affective themes within experimental stimuli can help or harm creative performance.

Personality

Personality, defined as "the unique and relatively enduring set of behaviors, feelings, thoughts, and motives that characterize an individual," (Feist, 2010, p. 114; Vartanian, 2019) is a conspicuous construct within the creativity and humor literature. This subsection will focus on the Big-Five dimensions of personality (McCrae & Costa, 1987) and describe research showing that certain domains are related to individual differences in both humor and creativity.

The creative process can be divided into two phases. Phase one involves the generation of novel ideas. Phase two involves evaluating and selecting the most meaningful and useful ideas generated in phase one (Simonton, 2013a). Phase one is less focused and makes use of divergent cognitive thought processes while phase two employs more convergent processes such as cognitive control and focused attention – and different personality traits are associated with each phase (Feist, 2019; Fürst et al., 2016).

At the creativity and personality intersection, openness to experience (i.e., enjoying novel experiences; being intellectually and experientially curious) is of particular interest. This is because it is the domain most consistently and strongly associated with creativity across a variety of outcome measures, and even age (DeYoung, 2014; Feist, 1998, 1999, 2010, 2019; Kaufman, 2016). For instance, a meta-analysis by Feist (1998) found that creative scientists and artists scored higher on openness to experience than non-scientists and non-artists, respectively. Openness can even predict engagement in creative activities, as well as intelligence, which predicts creative achievement (Jauk et al., 2014). Neuroscience research has also shown that as openness scores increase, the default-mode network (e.g., mind-wandering, spontaneous thinking), which includes many cognitive processes related to creativity, becomes more efficient (Beaty et al., 2016; Vartanian, 2019). Cognitive flexibility, the ability to come up with ideas from different categories and to fluidly switch between them, is also a strong characteristic of creative thought and is positively related to the openness to experience personality dimension (Feist, 2019; Guilford, 1968).

According to a survey from 1961, 94% of people think their sense of humor is average or above average (Allport, 1961). More recently Cann and Calhoun (2001) found that only 2% of people think their sense of humor is below average. People with a good sense of humor were also

rated higher on a number of other socially desirable traits such as friendliness, intelligence, creativity, extraversion, agreeableness, openness to experience, and even being considerate. “When people say that others have a good sense of humor, it implies a curious, unconventional, sociable type who rarely gets worked up” (Earleywine, 2011, p. 85). With some exceptions, this is similar to the creatives who tend to be autonomous, ambitious, hostile, dominant, impulsive, confident, extraverted, and open to experience (Feist, 1998). Early researchers even viewed a sense of humor as a component of the creative personality (Murdock & Ganim, 1993).

After openness to experience, the social personality trait of extraversion has the next strongest and most robust connection with creativity (Feist, 1998; 2019). While the research on extraversion is mixed, those scoring higher on the trait are found to have a greater attentional breadth compared to introverts and tend to generate more original, fluent, and flexible responses characteristic of divergent thinking (Aguilar-Alonso, 1996; Chamorro-Premuzic, & Furnham, 2009; Furnham & Nederstrom, 2010; Kasof, 1997). The meta-analysis by Feist (1998) also found creative scientists were more extraverted than less creative scientists.

In general, conscientiousness and neuroticism are negatively related to creativity (Dollinger et al., 2004; Martindale & Daily, 1996). Artists tend to be less conscientious and more neurotic than non-artists (Feist, 1998). Likewise, advertising and design workers were found to be less conscientious, but more neurotic, extraverted, and open to experience (Galade, 1997). However, conscientiousness can help those who are less creative naturally to compensate and eventually produce accomplishments of their own (Feist, 1998; King et al., 1996). Batey and Furnham (2006) found everyday creativity was positively related to agreeableness, but artistic and scientific creativity were negatively related. Hunter and Cushenbery (2015) found that a

disagreeable person's idea was more likely to be endorsed by a group, even though it was not any more creative.

Both humor and creativity are multifaceted and complex, partly domain-specific, and result from individual differences in cognition and personality (Barbot & Eff, 2019; Sternberg & Lubart, 1995). In their investment theory of creativity, Sternberg and Lubart (1991) propose that intelligence, knowledge, cognitive style, personality, motivation, and environment are creative resources. Within intelligence, the ability to redefine problems and think insightfully were particularly important for creativity (Kaufman et al., 2008). Humor comprehension in the form of incongruity-resolution and/or problem-solving seems to imply interrelationships among humor, creativity, intelligence, and personality (Martin, 1998). While this dissertation does not specifically concern intelligence, its contribution in the background is undeniable.

Overview and Hypotheses

In this dissertation I conducted three experimental studies concerning exposure to humor and creativity. Given that humor shares many qualities with creativity, my primary aim was to examine whether exposure to humor specifically can augment creative thinking more than general positive emotions.

To date, there is (to my knowledge) no known research that tests exposure to various types of memes on creative performance or that examines this outcome by distinguishing between different types of humor, such as sarcasm or irony. Furthermore, those studies which did incorporate sarcasm into their designs did not also test performance compared to a different form of humor, nor did they use a divergent task as their dependent variable. To my knowledge there is no study which investigates any of these comparisons. In addition, past research that did measure both humor and creativity together tended to be rather dated, plagued with inadequate

methodology, and lack proper psychometric reliability and validity (Kaufman et al., 2008; Köhler & Ruch, 1996; Sheehy-Sheffington, 1997). Therefore, the purpose of this dissertation was to not only discern whether humor has a unique influence on creativity, but to also explore the humor-creativity relationship to a greater extent than has been done in any prior study before. Based on the existing literature on both humor and creativity, I tested several predictions in this dissertation.

Hypothesis One

Participants in the positive affect condition will show improved performance (i.e., higher fluency and novelty scores) on the divergent thinking creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the neutral affect condition, consistent with prior research (Baas et al., 2008).

Hypothesis Two

Hypothesis 2a

Participants in the humor condition will show improved performance (i.e., higher fluency and novelty scores) on the divergent creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the neutral condition, also consistent with prior research. Many affect studies which induced positive mood did so with a humorous manipulation which they compared to a neutral control and found improved performance on the creativity outcomes (Baas et al., 2008).

Hypothesis 2b

Participants in the humor condition will show improved performance (i.e., higher fluency and novelty scores) on the divergent creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the positive affect condition.

Positive moods that are activating (e.g., happiness, amusement) are especially more likely to show enhanced creative performance (Baas et al., 2008). Appreciating a joke can not only improve one's mood, but also lead to broadened thought-action repertoires. Additionally, incorporating and resolving the incongruity within humor is thought to use similar free thinking and schema-shifting abilities which are also active in creative thinking (Chen et al., 2018; Fredrickson, 2001; Koestler, 1964). Therefore, humor is expected to induce positive mood and provide a creative priming effect, yielding an advantage to those in the humor condition over those who are in the positive affect condition.

Hypothesis Three

Hypothesis 3a

Participants in the ironic condition will show improved performance on both the divergent (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks) and convergent (i.e., higher total scores on the Remote Associates Test and anagram tasks) creativity tasks compared to those in the neutral condition.

Past research measuring sarcasm found support for its facilitation on convergent tasks relative to non-sarcastic expression (Huang et al., 2015; Miron-Spektor et al., 2011; Smith & White, 1965). To explain this, Smith and White (1965) suggested that sarcasm is a more complex form of humor because it requires one to create a joke that also communicates a message. Miron-Spektor et al. (2011) proposed that sarcasm lowers creative inhibition by allowing one to express anger in a more indirect way. All three of these studies used a convergent task as the outcome. Consistent with this prior research (sarcasm is a form of irony), those who view ironic pictures are expected to show improved performance on the convergent tasks relative to those in the neutral condition. However, I also believe irony can facilitate divergent performance because it

is still considered humorous material and should bestow the same creative benefits as other forms of humor. Additionally, it contains contrasting information, and the literature shows that holding opposing information simultaneously is also beneficial to divergent tasks (Barron & Harrington, 1981; Csikszentmihalyi, 1996; Huang, 2020).

Hypothesis 3b

Participants in the ironic condition will show improved performance on both the divergent (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks) and convergent (i.e., higher total scores on the Remote Associates Test and anagram tasks) creativity tasks compared to those in the humor condition.

Feelings of amusement are anticipated for those in both the humor and ironic conditions but understanding and constructing an ironic statement may increase the saliency of the contrasting elements that compose the humorous message. In addition, understanding an ironic statement is more effortful than understanding a non-ironic one (McDonald, 1999). If abstract thinking helps one both decipher the intended meaning from a sarcastic statement and is helpful for creativity, then those in the ironic condition may show improved creative performance over those who are in the humor condition because understanding irony is more effortful, and participants may already be primed to think in ways foundational to creative insight.

Hypothesis Four

Certain personality traits will be more beneficial for different types of creative performance.

Hypothesis 4a

Those who are higher on openness to experience and who are in the positive and humor conditions are expected to perform better on the divergent creativity tasks (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks).

Hypothesis 4b

Those who are higher on extraversion and who are in the positive and humor conditions are expected to perform better on the divergent thinking tasks (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks).

Hypothesis 4c

Those who are higher in conscientiousness and are in the irony condition are expected to perform better on the convergent creativity tasks (i.e., higher total scores on the Remote Associates Test and anagram tasks).

These hypotheses align with the conclusions within the personality component of the Investment Theory of Creativity by Sternberg and Lubart (1991). Openness to experience has an extensive relationship to divergent thinking, but other traits conducive to creativity include open-mindedness, confidence, curiosity, tolerance to ambiguity, sensible risk-taking, and a desire to overcome obstacles and persevere (Chamorro-Premuzic & Reichenbacher, 2008; Kaufman, 2016; McCrae, 1987; Williams, 2004). It is expected that those who are higher on openness will perform better on the divergent thinking tasks, but those who are in either the positive or humor conditions will perform even better due to the theoretical boost provided by positive mood in the form of amusement.

Extraverts are found to have a greater attentional breadth compared to introverts and tend to generate more original, fluent, and flexible responses characteristic of divergent thinking – the

lower cortical activity found in more extraverted individuals may be ideal for the production of creative and original ideas (Aguilar-Alonso, 1996, Eysenck, 1967; Kasof, 1997; Fink & Neubauer, 2008). Extraverts are also more responsive to positive mood inductions and tend to like more types of jokes than introverts (Larsen & Ketelaar, 1989; Ruch, 1992; Ruch & Hehl, 1998). Therefore, it is expected that those who are higher on extraversion will perform better on the divergent tasks, but those who are in the positive or humor conditions will perform even better due to the positive affective boost given their tendency to enjoy more forms of humor.

Persistence is a facet of conscientiousness that describes one's desire to complete difficult tasks and persist through challenges (Dudley et al., 2006; McClelland, 1961). Those higher in conscientiousness may operate through a persistence pathway beneficial for convergent tasks such as anagrams (Nijstad et al., 2010). Unfortunately, there seems to be no relationship between humor and conscientiousness (Earleywine, 2011), but because understanding irony is more effortful and possibly traverses appropriate psychological distance, those who are higher on conscientiousness may persist longer on the convergent tasks – and they may be primed to do so when exposed to ironic stimuli.

Hypothesis Five

Those asked to explain the pictures in some conditions will perform better on the creativity tasks compared to those who are not asked to explain.

Hypothesis 5a

Participants who are in the positive explain condition will perform better on the divergent creativity tasks (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks) compared to those who are in the positive non-explain condition, as well as both the neutral non-explain and explain conditions.

Hypothesis 5b

Participants who are in the humor explain condition will perform better on the divergent creativity tasks (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks) compared to those who are in the humor non-explain condition, as well as both the neutral non-explain and explain conditions.

The creativity theories discussed earlier seem to suggest that certain moods help individuals get into a mindset that will be beneficial to certain types of creative tasks. Humor theories emphasize a more cognitive approach where the processing of a joke is similar to creative thinking, whereas creativity theories emphasize a more affective approach where positive mood is found to benefit creative performance most consistently. It is expected that those who are asked to explain why the photos in their condition contain positive or humorous themes will experience a stronger induction of positive mood than those who simply view the photos and will thus perform better on the creativity tasks.

Rouff (1975) conducted a study where she manipulated cartoons to be with and without captions. Participants wrote explanations of the point of each cartoon which were then scored for quality; however, all participants were asked to engage in this exercise. She found those who comprehended the humor better also scored better on the RAT, but she did not include another condition where participants did not write explanations.

To my knowledge no other study has tested this prediction directly, but I predict as such because the deeper level of processing exercised when responding with an explanation may provide a cognitive prime that is beneficial for the creativity tasks that follow. This idea will be tested in study three.

Pilot Study

Prior to the main experiments, a pilot study was conducted to verify that the picture manipulations were effective at inducing the appropriate emotional states as well as to anticipate and address potential survey software malfunctions.

Pilot Picture Stimuli

To identify which pictures to present to participants for each condition, a pilot survey was created with 60 photos. Twenty-three individuals rated each photo along three dimensions, all on seven-point Likert scales. For each photo presented, respondents were instructed to indicate how positive, humorous, and offensive it was. The positive dimension ranged from 1 (*very negative*) to 7 (*very positive*), humorous from 1 (*not at all humorous*) to 7 (*very humorous*), and offensive from 1 (*not at all offensive*) to 7 (*very offensive*).

From these data, the mean ratings of each picture for each dimension were arranged in descending order. Highly rated photos were then considered for the experimental conditions. The highest-rated photos for the positivity dimension were considered for the positive condition; the highest-rated photos for the humorous dimension were considered for the humor condition, and middle-scoring photos for positivity and humor were considered for the neutral condition.

A collection of ten pictures for each respective condition was then compiled. Selection was considered complete when the mean for positivity among the 10 photos selected for the positive condition was higher than the positivity score for the 10 photos selected for the humor and neutral conditions; likewise, when the mean for humor among the 10 photos selected for the humor condition was higher than the humor score for the 10 photos selected for the positive and neutral conditions.

Ratings of offensiveness were also examined within each selection of photos for each of the experimental conditions. A score of four (i.e., midpoint) or more for offensiveness was determined to be the cutoff for inclusion. No photos included in any of the experimental conditions exceeded this value (See Table 1).

Pilot Study Method

Participants

The sample consisted of individuals recruited from the University of Texas at Arlington's Psychology Department participant pool (SONA). There was a total of 92 participants recruited from the student pool. Eligibility required the participant to be at least 18 years of age or older, be currently enrolled as a student at the University of Texas at Arlington, and to speak English. Data screening was conducted, and 6 (7%) participants were excluded due to poor quality data (n = 1; irrelevant responses to creativity task) or they scored a three or lower on the memory task (n = 5). This left a sample of 86 participants. In exchange for completing the study, each participant was granted .5 research credits. Individuals were primarily female (84.9%) and Hispanic/Latino(a) (39.5%), ranging in age from 18 to 30 (M = 18.95, SD = 1.97). There were 29 participants in the positive condition, 32 in the humor condition, and 25 in the neutral condition. See Table 2 for complete demographics.

Measures and Materials

Through the course of their participation, individuals completed a personality measure, baseline emotion measure, viewed a set of 10 photos, completed a post-manipulation emotion measure (50%), two creativity tasks, a memory task, and a demographics section.

Ten-Item Personality Inventory

The Ten-Item Personality Inventory (TIPI; Gosling et al., 2003) was completed before the creativity tasks. This personality assessment is based on the Big-Five personality domains and was created for situations where brief measures of personality are desired. Participants respond on a scale from 1 (*Disagree strongly*) to 7 (*Agree strongly*). An example item is, "Extraverted/enthusiastic." Test-retest reliability of this measure averages at .72 and is shown to have adequate convergent and discriminant validity compared to the Big-Five Inventory (Gosling et al., 2003; John & Srivastava, 1999).

Emotion Measure

All participants completed a baseline emotion measure at the beginning of the study (i.e., immediately before their respective mood manipulation). To gauge mood change after the manipulation as well as to minimize interference of completing a mood survey before moving to the creativity tasks, the appearance of a second identical post-manipulation emotion measure was randomized to appear to half of the sample.

The baseline emotion measure was created for the purposes of this research and was inspired by the Positive and Negative Affect Scale (PANAS). The PANAS is a widely used valid and reliable ($\alpha_{\text{positive affect}}$ = .86-.90) measure of self-reported affect (Watson et al., 1988). This measure asked participants to select the number that best described how they felt at this moment using a response range of 1 (*very slightly or not at all*) to 5 (*extremely*) for the dimensions of happy, amused, bored, upset, and confused.

All participants completed the emotion measure before viewing the pictures in their respective conditions. A random 50% selection of the sample (determined using the randomizer provided on QuestionPro) also completed this scale immediately after viewing their photos. This

was done to counterbalance any potential creativity-interfering mood effects activated by completing the emotion measure prior to completing the creativity tasks.

This measure intended to serve as a manipulation check for determining if the picture condition effectively induced the desired mood states of individuals in each condition. For example, participants were expected to select a higher option for the "amused" dimension if they were in the humor condition relative to those in the other conditions.

Mood Manipulation

Participants in each condition viewed 10 photos designed for their respective mood induction conditions (i.e., positive, humor, neutral). Each picture within each condition was displayed for 12-seconds (Amrhein et al., 2004; Uhrig et al., 2016), in the same order to standardize exposure to the visual stimuli (see Appendix A).

Positive. The ten photos selected for the positive condition depicted images with wholesome themes such as happy animals and positive messages.

Humor. Photos selected for the humor condition depicted images with light-hearted themes, also including photos of some animals, but presented in a more purposefully humorous manner.

Neutral. Photos selected for the neutral condition contained humorous themes but, according to the pilot survey, were less effective at inducing a humor response.

Creativity Tasks

Participants were asked to complete the following two divergent creativity tasks. Each task was displayed one at a time, for five minutes (Benedek et al., 2013), in a random order (randomization was incorporated into the survey hosted by QuestionPro). Additionally, the

survey page was timed to move forward only at exactly five minutes (i.e., to restrict premature advancement and standardize time spent on each task).

Based on aspects of the SOI, tasks from the Torrance Tests of Creative Thinking (TTCT; Torrance, 1972) are the most commonly administered and published tests of divergent thinking in research settings (Kaufman et al., 2008). The two tasks used in this study originate from subtests within the verbal form of the TTCT. While both tasks appear to measure the same construct, they were both included because there is not consistent agreement about the validity of all creativity tests (Furnham et al., 2011). Additionally, in this study instructions differ between the two tasks. Participants are simply asked to list ideas for the Uses test, but are asked to specifically list clever, interesting, and unusual ideas for the Product Improvement task. Finally, it is easy to find uses for a paperclip (i.e., Uses test) from a Google search (which may be an invisible influence in creativity scoring), but not for the Product Improvement task.

Unusual Uses. Within his SOI model, J.P. Guilford created the Unusual (or Alternative) Uses brainstorming test as a way to assess divergent thinking (or according to him, "spontaneous flexibility"). For this test, participants are typically asked to list uses for common objects in a fixed period of time. This task is a prominent measure of divergent creativity in the literature and has shown to be a reliable indicator of creative potential (Guilford, 1956; Guilford et al., 1960; Kaufman et al., 2008; Kudrowitz & Dippo, 2013; Runco & Acar, 2012; Torrance, 1972). In this study, participants were asked to, "please list all the uses you can think of for a paperclip" and enter those ideas into a textbox on QuestionPro. This task was scored for fluency and originality (i.e., novelty) by trained raters.

Product Improvement. The product improvement task (Kaufman et al., 2008; Torrance, 1966; 1972) was another brainstorming task where participants were presented with a picture of

a stuffed elephant and asked to, “please list the cleverest, most interesting and unusual ways you can think of to change the toy elephant pictured above so that it is more fun to play with” and enter those ideas into a textbox on QuestionPro. This task was scored by trained raters for fluency and originality (See Appendix B for all measures).

Memory Task

After completing the creativity tasks, participants were presented with 10 pictures and asked to select which photos they saw at the beginning of the study. Half were pictures from their own condition and half were from a pool of extra photos not presented in any other condition (see Appendix C).

Demographics

Participants completed questions asking about their age, gender, race, and if English was their first language. In addition, they were asked to write what they believed the purpose of this study was, as well as to select an option indicating how interested they were in the photos shown to them earlier.

Procedure

This online study was conducted to verify if the picture manipulations were effective at inducing the intended emotional state respective to each condition as well as to anticipate potential survey software complications. This was a 3 (mood: positive vs. amused vs. neutral) x 2 (creativity task: unusual uses test vs. product improvement) mixed experimental design measuring the influence of moods on divergent creativity. Condition (i.e., mood) served as the between-subjects variable, while the creativity tasks served as the within-subjects variables.

Participants were recruited from the University of Texas at Arlington’s Psychology Department participant pool (SONA). The survey was hosted on QuestionPro where it was titled,

"Memory and Problem-Solving." Only participants who were 17 years of age or older and spoke English were eligible to participate. The survey in its entirety took approximately 20 minutes to complete.

After providing electronic informed consent, participants were asked to complete the TIPI, followed by the emotion measure. Next, participants were randomly assigned to one mood condition (selected by the QuestionPro randomizer) in which they viewed a set of 10 pictures, presented in a uniform order, and shown individually for 12-seconds. Following the mood manipulation, a random 50% selection of participants completed a second emotion measure (selected by the QuestionPro randomizer).

All participants were then asked to complete two divergent creativity tasks (i.e., unusual uses and product improvement; order randomized through QuestionPro). Each task was time-capped and restricted at five-minutes, meaning participants could not move forward before the timer reached zero. Therefore, a total of 10-minutes was allotted for creative idea generation.

After the creativity tasks, participants completed the memory task, followed by a short demographics section. The study concluded with an electronic debriefing about the true nature of the study. At any point, participants retained the freedom to withdraw from the study with partial credit and without penalty; however, there were no such requests. Likewise, at the time of the debriefing participants could elect to exclude their data from analyses; no such requests were received.

Data were analyzed using IBM's Statistical Package for the Social Sciences (SPSS, v.27).

Pilot Study Results

Data Screening and Coding

Prior to analysis, the data were checked for missing values as well as univariate and multivariate normality and outliers. Assumptions of linearity and homogeneity were considered satisfactory.

A team of nine trained undergraduate raters provided the novelty ratings for both the unusual uses and product improvement tasks. Five of these raters provided ratings for the ideas from the unusual uses test (*ICC* = .72) and four provided ratings for the ideas from the product improvement test (*ICC* = .85). These reliability values were considered adequate (Nunnally, 1978; Taber, 2017).

After completing the creativity tasks, participants were presented with a memory task where they saw a set of 10 photos and were told to select the photos they remember seeing in their respective mood manipulation. There were five previously shown pictures presented in the same pattern for each version of this task.

Participants performed well, with 95% of the sample selecting at least four or more of the correct pictures and 87% selecting only and all of the correct pictures. Only two people selected just one correct photo and only three people selected only two correct photos. These five individuals were removed from the analyses due to their disproportionately poor performance.

Emotion Measure Manipulation Check

A one-way Multivariate Analysis of Variance (MANOVA) was initially conducted to assess if there were any differences on each of the dimensions of the emotion measure across conditions at baseline. Condition served as the independent variable and baseline scores for happiness, amusement, boredom, upset, and confusion served as the dependent variables. There

was no multivariate effect, Wilks' (10, 158) = 1.09, $p = .376$, $\eta_p^2 = .06$, suggesting no pre-existing differences in mood at baseline across conditions.

Next, a series of 3 (condition: positive vs. humor vs. neutral) x 2 (emotion scale: pre vs. post) mixed ANOVAs were conducted for each emotion on this scale to assess whether the picture manipulation was effective respective to the three conditions, as well as to detect the potential presence of any negative influences (i.e., upset, confused). Condition served as the between-subjects factor and the pre and post measurements for each respective emotion served as the within-subjects factors. Table 3 contains the means for each dimension on the emotion measure both before and after the mood manipulation, separated by condition.

For the happiness dimension, the ANOVA revealed a main effect of happiness mood change, $F(1, 43) = 9.04$, $p = .004$, $\eta_p^2 = .17$, but no main effect of condition, $F(2, 43) = .70$, $p = .500$, $\eta_p^2 = .03$. Overall, participants reported feeling happier after the mood manipulation ($M = 4.05$, $SE = .13$) compared to before ($M = 3.61$, $SE = .16$), but the interaction between changes in feelings of happiness and condition was not significant, $F(2, 43) = 1.58$, $p = .218$, $\eta_p^2 = .07$. Examination by condition showed a significant positive change within the positive and humor conditions, but not the neutral.

For the amused dimension, the ANOVA revealed a main effect of amused mood change, $F(1, 43) = 25.08$, $p < .001$, $\eta_p^2 = .37$, but there was no main effect of condition, $F(2, 43) = .72$, $p = .494$, $\eta_p^2 = .03$, nor an interaction between changes in feelings of amusement and condition, $F(2, 43) = .22$, $p = .808$, $\eta_p^2 = .01$. Overall, feelings of amusement did significantly increase from time one ($M = 2.94$, $SE = .15$) to time two ($M = 3.74$, $SE = .16$). Examination by condition showed a significant positive change within all three conditions.

For the bored dimension, the ANOVA revealed a main effect of bored mood change, $F(1, 43) = 22.73$, $p < .001$, $\eta_p^2 = .35$, but no main effect of condition, $F(2, 43) = .59$, $p = .562$, $\eta_p^2 = .03$, nor an interaction between changes in feelings of boredom and condition, $F(2, 43) = 1.51$, $p = .232$, $\eta_p^2 = .07$. Overall, feelings of boredom did significantly decrease from time one ($M = 3.16$, $SE = .19$) to time two ($M = 2.30$, $SE = .21$). Examination by condition showed a significant negative change within the positive and humor conditions, but not the neutral.

For the confused dimension, the ANOVA revealed neither a main effect of confused mood change, $F(1, 43) = .07$, $p = .794$, $\eta_p^2 = .00$, a main effect of condition, $F(2, 43) = 1.56$, $p = .222$, $\eta_p^2 = .07$, nor an interaction between changes in feelings of confusion and condition, $F(2, 43) = 2.31$, $p = .111$, $\eta_p^2 = .10$.

Finally, for the upset dimension, the ANOVA revealed a main effect of upset mood change, $F(1, 43) = 5.03$, $p = .030$, $\eta_p^2 = .11$, but not a main effect of condition, $F(2, 43) = 2.13$, $p = .132$, $\eta_p^2 = .09$, nor an interaction between changes in feelings of confusion and condition, $F(2, 43) = .01$, $p = .990$, $\eta_p^2 = .00$. Overall, feelings of upset did significantly decrease from time one ($M = 1.72$, $SE = .12$) to time two ($M = 1.46$, $SE = .11$).

Pilot Study Discussion

The primary purpose of this pilot study was to examine whether the pictures chosen for the experimental conditions induced the proper mood changes in participants. Each dimension from the emotion scale was examined for changes from before to after the mood manipulation as well as if differences occurred within specific conditions.

Results indicated that feelings of happiness significantly increased after the picture manipulation in both the positive and humor conditions, but not the neutral condition. Change

scores and post-emotion scale happiness scores were highest in the positive condition, followed by the humor condition. This was expected as humor was used in past studies as a way to induce a positive mood, suggesting there should also be an increase in happiness within the humor condition as well. Because these results were consistent with expectations, the positive set of photos was retained and considered properly effective at inducing the appropriate affect.

Feelings of amusement significantly increased after the picture manipulation in all three conditions, increasing the most in the humor condition as expected. Each condition was shown a set of memes which had humorous themes (with the exception of the positive condition), so there should be at least some change in feelings of amusement within all three conditions. Change scores and post-emotion scale amusement scores were highest in the humor condition but were followed by the neutral condition. This shows the humorous set was the most effective at inducing feelings of amusement, but the remaining conditions also experienced some level of amusement as well. Because the humorous set of photos was effective at increasing feelings of amusement, especially in the humor condition, it was retained. However, means for post-emotion scale amusement within the humor and neutral conditions were close and may not have provided enough separation between conditions.

Feelings of boredom significantly decreased after the picture manipulation in both the positive and humor conditions, but not the neutral condition. Change scores indicated the strongest decrease was seen in the humor condition, followed by the positive condition. These results imply that the pictures in both the positive and humor conditions were sufficiently interesting. Unfortunately, the mean for boredom in the neutral condition was expected to show an increase, but it actually decreased here (indicating more interest rather than less), albeit it was not a significant change. Additionally, post-emotion scale boredom scores among all three

conditions were very similar, indicating the neutral condition was not as effective as anticipated at inducing feelings of boredom.

Participants reported feeling less upset after viewing the picture manipulation; however, no differences specific to condition were detected. Additionally, the analyses discovered no differences at all for confusion. The means for both confusion and upset remained below three both before and after the picture manipulation, indicating the experimental instructions were clear and the pictures did not induce any confounding negative emotions.

The results of this pilot study appear to suggest that positive mood was effectively induced in the positive condition and feelings of amusement were effectively induced in the humor condition.

The pictures in the neutral condition were chosen because they were rated near a four (i.e., midpoint) on the humorous and positive dimension of the picture selection survey. The intention was to select photos that were sufficiently interesting yet did not evoke as strong emotional responses as the other conditions. Unfortunately, the results suggested the intended neutral mood was possibly conflated with the other conditions for feelings of amusement and boredom, thereby not inducing proper separation of the intended emotional states.

Analyses concerning creative performance relative to mood condition were not reported because of this insufficient separation (no differences were detected). To address this issue, a new sample completed a revised survey with new pictures in an effort to find a more suitable selection of photos for the neutral condition (i.e., less humorous, more boring).

A secondary purpose of this pilot study was to anticipate any survey software malfunctions that could occur in future studies using this procedure; no issues were discovered. Therefore, a similar structure was implemented in the following studies.

Revised Picture Stimuli

The results of the pilot study indicated the neutral stimuli may not have induced a proper "neutral" mood. There was also a need to select ironic photos. Therefore, a revised survey with 132 photos was created.

Respondents were shown a random selection of 55 photos to rate along five dimensions (positive, humorous, boring, offensive, sarcastic), all on a seven-point Likert scale. For each photo presented, respondents were instructed to indicate their feelings on each dimension. The positive dimension ranged from 1 (*very negative*) to 7 (*very positive*), humorous from 1 (*not at all humorous*) to 7 (*very humorous*), boring from 1 (*very boring*) to 7 (*very interesting*), offensive from 1 (*not at all offensive*) to 7 (*very offensive*), and ironic from 1 (*not at all sarcastic/ironic*) to 7 (*very sarcastic/ironic*). Because this survey presented a random selection of photos, respondents were additionally instructed to complete this survey only once and in one sitting.

A total of 27 individuals completed this survey. Following a similar procedure from the first picture selection survey, the mean ratings of each picture for each dimension were arranged in descending order. Highly rated photos were then considered for the neutral and ironic experimental conditions (photo selections from positive and humor conditions remained the same). The highest rated photos for the sarcasm/irony dimension were considered for the irony condition and the lowest rated photos for the boring dimension were considered for the neutral condition.

A collection of 10 images for the two remaining conditions were created. Selection was considered complete when the mean of each set of 10 for the dimension corresponding to each condition was higher than the other conditions for the positivity, humorousness, and

sarcasm/irony dimensions, and lower for the boring dimension. For example, if the mean for sarcasm/irony was highest in the set intended for the ironic condition, relative to the set intended for the other conditions.

Ratings of offensiveness were additionally examined within each selection of photos for each of the experimental conditions. A score of four (i.e., midpoint) or more for offensiveness was determined to be the cutoff for exclusion. No photos included in any of the experimental conditions exceeded this value (See Table 4).

The results of this revised pilot study were then implemented into study one (See Table 5 for descriptive statistics about each photo within each condition).

Study One

The purpose of study one was to replicate the positive mood effect found in prior research (Baas et al., 2008; Hirt et al., 2008; Isen et al., 1987; Madrid et al., 2014), where creativity scores were higher in a positive mood condition relative to a mood-neutral control. Another purpose was to test whether comedy provides a creative advantage relative to a positive mood as well as to a mood-neutral control.

Study One Method

Participants

The sample was composed of individuals recruited from both the University of Texas at Arlington's Psychology Department participant pool (SONA) as well as Amazon's Mechanical Turk (mTurk).

For the SONA sample, 67 participants were recruited from the student pool. Eligibility for the SONA sample required the participant to be at least 17 years of age or older, be currently enrolled as a student at the University of Texas at Arlington, and to speak English. Data

screening was conducted, and five participants (7.5%) were excluded due to either not completing the creativity tasks at all (n = 1), providing poor quality data (e.g., ideas from the paperclip task were found on google; n = 2), or were excluded because of unsatisfactory performance on the memory test (i.e., scoring 3 or less; n = 2). The remaining SONA sample size was 62 participants (see Table 6 for complete demographics). In exchange for completing the study, each participant was granted research credits at a rate of one credit per hour (i.e., participants were granted .5 credits for the 30-minutes estimated to complete this study).

For the mTurk sample, 31 participants were recruited from the worker pool. Eligibility for the mTurk sample required the participant to be at least 18 years of age or older, speak English, and reside in the United States. Data screening resulted in the exclusion of four individuals (12%) because either their mTurk ID could not be matched (i.e., payment could not be verified; n = 1), upon cleaning the data the response was found to be of poor quality (n = 1), location meta-data revealed the individual resided outside of the United States (n = 1), or because of unsatisfactory performance on the memory test (n = 1). The remaining mTurk sample size was 27 participants (see Table 7 for complete demographics). In exchange for completing the study, each participant was compensated $2.00 USD.

This resulted in a combined sample of 89 total participants. Individuals were primarily female (76.4%) and Caucasian (40.4%), ranging in age from 17 to 77 (M = 28.51, SD = 13.74). There were 29 participants in the positive condition, 28 in the humor condition, and 32 in the neutral condition. See Table 8 for complete combined demographics.

Experimental Design

This online study was designed to test if viewing a set of 10 pictures was effective at inducing various moods; concurrently, it was also interested in detecting if some of these moods

can improve creative performance. The procedure closely parallels that discussed in the pilot study, with a few modifications and additions.

This was a 3 (mood: positive vs. amused vs. neutral) x 4 (creativity task: unusual uses test vs. product improvement vs. remote associates test vs. anagrams) mixed experimental design measuring the influence of moods on divergent and convergent creativity. Condition (i.e., mood) served as the between-subjects independent variable, while the creativity tasks served as the within-subjects dependent variables.

Measures and Materials

Through the course of their participation, individuals completed a personality and humor styles assessment, baseline emotion measure, viewed a set of 10 photos, completed a post-manipulation emotion measure (50%), four creativity tasks, a memory task, and a demographics section.

Ten-Item Personality Inventory

The Ten-Item Personality Inventory (TIPI; Gosling et al., 2003) was completed before the creativity tasks. This personality assessment is based on the Big-Five personality domains and was created for situations where brief measures of personality are desired. Participants respond on a scale from 1 (*Disagree strongly*) to 7 (*Agree strongly*). An example item is, "Extraverted/enthusiastic." Test-retest reliability of this measure averages at .72 and is shown to have adequate convergent and discriminant validity compared to the Big-Five Inventory (Gosling et al., 2003; John & Srivastava, 1999).

Humor Styles Questionnaire

The Humor Styles Questionnaire (Martin et al., 2003) was added to this survey to explore the relationships among various styles of humor and the creativity tasks measured in this study.

Participants answered eight questions for each of the four humor styles (32 questions total) on a 1 (*completely disagree*) to 7 (*completely agree*) scale. Answers to each question respective to each style are then summed. Reliability analyses for each sub-scale report Cronbach alphas ranging from .82 to .88.

Emotion Measure

All participants completed the same baseline emotion measure as in the pilot study. This measure asked participants to select the number that best described how they felt at this moment using a response range of 1 (*very slightly or not at all*) to 5 (*extremely*) for the dimensions of happy, amused, bored, upset, and confused.

Likewise, a second identical post-manipulation emotion measure was randomized to appear to half of the sample.

Mood Manipulation

Participants in each condition viewed 10 photos designed for their respective mood induction conditions (i.e., positive, humor, neutral). Each picture within each condition was displayed for 12-seconds, in the same order, with the intention to standardize exposure to the visual stimuli.

The same photos used in the pilot study for the positive and humor conditions were also used in the positive and humor conditions here for study one.

Positive. The 10 photos selected for the positive condition depicted images with wholesome themes such as happy animals and positive messages.

Humor. Photos selected for the humor condition depicted images with light-hearted themes, also including photos of some animals, but presented in a more purposefully humorous manner.

Neutral. New photos were selected for the neutral condition based on the data from the revised picture stimuli survey discussed after the pilot study. These new photos were selected based on their low score for the boring dimension on the survey (the lower anchor was *very boring* and the higher anchor was *very interesting*).

Creativity Tasks

Participants were asked to complete the same creativity tasks as in the pilot study, with the addition of two convergent tasks. Following the procedure in the pilot study, each task was displayed, one at a time, for five-minutes, in a random order for each participant. Randomization of tasks was configured on QuestionPro to be evenly presented across participants. Additionally, the survey page was timed to move forward only at exactly five-minutes to restrict premature advancement before the five-minutes was reached as well as to standardize the amount of time participants worked on each task.

Unusual Uses. Participants were asked to "please list all the uses you can think of for a paperclip" and enter those ideas into a textbox on QuestionPro. This task was scored for fluency and originality (i.e., novelty) by trained raters.

Product Improvement. Participants were presented with a picture of a stuffed elephant and asked to "please list the cleverest, most interesting and unusual ways you can think of to change the toy elephant pictured above so that it is more fun to play with" and enter those ideas into a textbox on QuestionPro. This task was scored by trained raters for fluency and originality.

Remote Associates Test. The Remote Associates Test (Mednick, 1962) was designed to test one's ability to detect common associations among remote concepts. Participants are given three words where they respond by entering in a word they believe unites the three in the set. For example, one test item may ask participants to find the word that unites dew, comb, and bee (answer: honey). According to Mednick, this ability to identify commonalities among remote ideas was indicative toward the probability of reaching a creative solution. Further, creative people are said to be capable of accessing more extensive associations to a stimulus (i.e., have a "flat" associative hierarchy), whereas associations in non-creatives tend to be finite and rigid (i.e., have a "steep" associative hierarchy; Kenett et al., 2014, 2018; Russ & Dillon, 2011; Vartanian, 2019).

In this study, participants were given 17 sets of three words where they responded by entering into a textbox the word they believe is the associate. Test items were identical to those used in the Huang et al. (2015) with the intention of replicating their findings. This task was considered a convergent creativity task as scoring instructions only provide one acceptably correct solution (Khalil et al., 2019; Radel et al., 2015).

Anagrams. Participants were presented with 13 six-letter single- or double-solution anagrams which participants were asked to solve by entering their answer in a textbox below each scrambled word. This task can be considered a measure of cognitive flexibility as it requires mental rearrangement of letters to create a word (Beversdorf et al., 1999; Ghacibeh et al., 2006). This task was also considered a convergent creativity task as the answer can (typically) be only one solution.

Memory Task

Participants were presented with the same memory task as described in the pilot study. Individuals were presented with 10 pictures and asked to select which photos they saw at the beginning of the study. Half were pictures from their own condition and half were from a pool of extra photos not presented in any other condition.

Demographics

Participants completed questions asking about their age, gender, race, and if English was their first language. In addition, they were asked to write what they believed the purpose of this study was, as well as select an option indicating how interested they were in the photos shown to them earlier.

Procedure

Data were collected using the online data collection software QuestionPro. Participants were recruited from the University of Texas at Arlington's Psychology Department participant pool (SONA) as well as Amazon's Mechanical Turk (mTurk). For the SONA sample, only participants who were 17 years of age or older and spoke English were eligible to participate. For the mTurk sample, only participants who were 18 years of age or older, spoke English, and resided in the United States were eligible to participate. The survey in its entirety took approximately 35 minutes to complete.

After providing electronic informed consent, participants were asked to complete the TIPI, followed by the HSQ, and subsequently the emotion measure. Next, participants were randomly assigned to one mood condition (selected by the QuestionPro randomizer) in which they viewed a set of 10 pictures, presented in a uniform order, and shown individually for 12-

seconds. Following the mood manipulation, a random 50% selection of participants completed a second emotion measure (selected by the QuestionPro randomizer).

All participants were then asked to complete four creativity tasks (i.e., unusual uses, product improvement, remote associates, anagrams; order randomized through QuestionPro). Each task was time-capped and restricted at five-minutes, meaning participants could not move forward before the timer reached zero. Once the five-minutes was reached the page automatically progressed to the next creativity task. Therefore, a total of 20-minutes was allotted for creative idea generation and/or problem-solving.

After the creativity tasks, participants completed the memory task, followed by a short demographics section. The study concluded with an electronic debriefing about the true nature of the study. At any point, participants retained the freedom to withdraw from the study with partial credit and without penalty; however, there were no such requests. Likewise, at the time of the debriefing, participants could elect to exclude their data from analyses; no such requests were received.

Data were analyzed using IBM's Statistical Package for the Social Sciences (SPSS, v.27) as well as the PROCESS (Hayes, 2020) macro.

Study One Results

Data Screening and Coding

Prior to running the main analyses, the data were checked for missing values as well as univariate and multivariate normality and outliers (even though MANOVA is considered robust to non-normality when there are at least 20 cases in the smallest cell; Mardia, 1971; Seo et al., 1995; Tabachnick & Fidell, 2007). Independence was ensured as much as possible by the

random sampling and random assignment to experimental conditions; likewise, the creativity tasks were presented in random order.

Results of the evaluation for normality, outliers, linearity, multicollinearity, and homogeneity of variance, and homogeneity of variance-covariance matrices were mostly satisfactory. *F* tests tend to be robust to modest violations and generally have minimal influence if the groups are relatively equal (i.e., $N_{\text{neutral (largest group)}} = 32 \div N_{\text{humor (smallest group)}} = 28 < 1.5$; Hair et al., 2013) so the assumptions were considered to be satisfied. For the moderated regressions, inspection of influential observations revealed three highly extraverted individuals who were both outliers and leverage points. These individuals were excluded from analyses concerning extraversion.

A team of ten trained undergraduate raters provided the novelty ratings for both the unusual uses and product improvement tasks. Six of these raters provided ratings for the ideas from the unusual uses test (*ICC* = .79) and four provided ratings for the ideas from the product improvement test (*ICC* = .83). These reliability values were considered adequate (Nunally, 1978; Taber, 2017).

Fluency was scored by the author who was, at the time, blind to each participant's condition. Participant responses were separated by identifying unique ideas within their submission and subsequently counting those responses relevant to the task. Ideas that were overtly not on-task were excluded from the counts. For example, responses such as, "right now as I am writing this, I can see a paperclip at my desk with my other supplies and smiling at it" was not counted.

The RAT and anagram tasks were scored by the author as well. Scores of "1" (i.e., correct response) or "0" (i.e., incorrect response) were assigned to each person according to their

respective response to each item of each task. These scores were then summed to obtain total correct scores for each convergent task.

Correlations were run to assess the relationships among the dependent variables for inclusion in the MANOVA. There was a moderately strong association between fluency scores for the unusual uses and product improvement tasks, $r(87) = .66$, $p < .001$, $r^2 = .44$; however, unexpectedly, there was no association between novelty scores, $r(87) = .05$, $p = .613$. See Table 9 for complete matrix. As moderate correlations among the dependent variables are acceptable for MANOVA, but near-zero correlations are not (Tabachnick & Fidell, 2013; Woodward et al., 1990), for the main analyses a MANOVA was conducted with both fluency variables entered as dependent variables, but separate ANOVAs were conducted for each dependent variable of novelty.

Manipulation Checks

Emotion Scale

To establish a baseline, all participants were given the emotion scale measuring feelings of happiness, amusement, boredom, upset, and confusion prior to viewing the pictures in their respective mood condition. A random 50% subset received the same emotion scale after the mood manipulation.

To assess the degree to which participants' moods changed as a result of viewing the pictures, a series of two-way mixed factors ANOVAs were conducted with condition as the between-subjects variable, and with emotion scale scores before and after the mood manipulation serving as the within-subjects variable. Table 10 contains the means for each dimension on the emotion measure both before and after the mood manipulation, separated by condition.

A one-way MANOVA was initially conducted to assess if there were any differences on each of these emotions across conditions at baseline. Condition was the independent variable and baseline scores for happiness, amusement, boredom, upset, and confusion served as the dependent variables. There was no multivariate main effect of condition found, Wilks' (10, 164) = 1.54, $p = .13$, $\eta_p^2 = .09$, indicating no pre-existing differences in mood at baseline.

For the happiness dimension, the ANOVA revealed a main effect of happiness mood change, $F(1, 46) = 5.76$, $p = .020$, $\eta_p^2 = .11$, but no main effect of condition, $F(2, 46) = 1.19$, $p = .313$, $\eta_p^2 = .05$. There was, however, a significant interaction between changes in feelings of happiness and condition, $F(2, 46) = 7.68$, $p = .001$, $\eta_p^2 = .25$. Overall, feelings of happiness did significantly increase from time one ($M = 3.73$, $SE = .14$) to time two ($M = 3.97$, $SE = .16$). Examination by condition showed a significant positive change within the positive and humor conditions, but not the neutral.

For the amused dimension, the ANOVA revealed a main effect of amused mood change, $F(1, 46) = 39.04$, $p < .001$, $\eta_p^2 = .46$, but there was no main effect of condition, $F(2, 46) = .19$, $p = .828$, $\eta_p^2 = .01$, nor an interaction between changes in feelings of amusement and condition, $F(2, 46) = 1.30$, $p = .281$. Overall, feelings of amusement did significantly increase from time one ($M = 3.10$, $SE = .16$) to time two ($M = 3.91$, $SE = .15$). Examination by condition showed a significant positive change within all three conditions.

For the bored dimension, the ANOVA revealed a main effect of bored mood change, $F(1, 46) = 17.89$, $p < .001$, $\eta_p^2 = .28$, but no main effect of condition, $F(2, 46) = .56$, $p = .575$, $\eta_p^2 = .02$, nor an interaction between changes in feelings of boredom and condition, $F(2, 46) = .45$, $p = .644$, $\eta_p^2 = .02$. Overall, feelings of boredom did significantly decrease from time one ($M = 2.65$,

SE = .18) to time two (*M* = 2.09, *SE* = .16). Examination by condition showed a significant negative change within the positive and humor conditions, but not the neutral.

For the confused dimension, the ANOVA revealed neither a main effect of confused mood change, $F(1, 46) = .00$, $p = .985$, $\eta_p^2 = .00$, a main effect of condition, $F(2, 46) = 2.44$, $p = .098$, $\eta_p^2 = .10$, nor an interaction between changes in feelings of confusion and condition, $F(2, 46) = 1.52$, $p = .229$, $\eta_p^2 = .06$.

Finally, for the upset dimension, the ANOVA revealed neither a main effect of upset mood change, $F(1, 46) = 3.13$, $p = .083$, $\eta_p^2 = .06$, a main effect of condition, $F(2, 46) = .63$, $p = .539$, $\eta_p^2 = .03$, nor an interaction between changes in feelings of confusion and condition, $F(2, 46) = 1.35$, $p = .268$, $\eta_p^2 = .06$.

Memory Task

After completing the creativity tasks, participants were presented with a set of 10 photos and told to select the photos they remember seeing in their respective mood manipulation. There were five previously shown pictures presented in the same pattern for each version of this task.

Participants performed well, with 97% of the sample selecting at least four or more of the correct pictures and 84% selecting only and all of the correct pictures. Only one participant selected just two correct photos and only two participants selected just three correct photos. These three individuals were removed from the analyses due to their disproportionately poor performance.

Hypothesis Tests

Hypotheses tested in study one included hypothesis 1, 2a, 2b, 4a, and 4b. A familywise significance level of .05 was used for all analyses.

Hypotheses 1, 2a, and 2b

The first and second hypotheses were tested by conducting a series of ANOVAs with various divergent outcomes from the unusual uses and product improvement data.

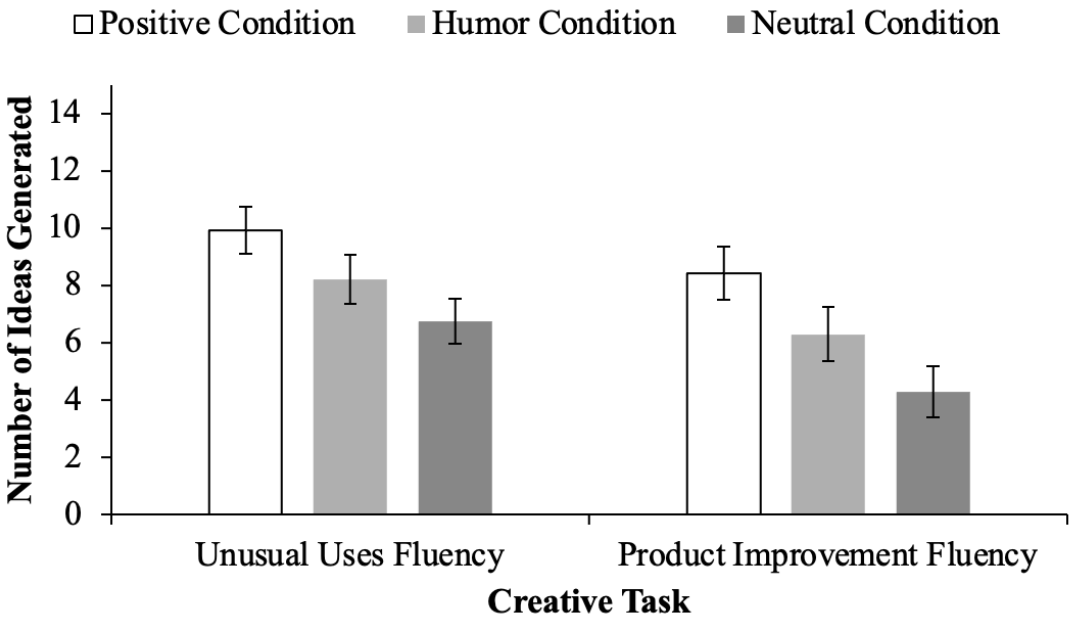
The first hypothesis was that participants in the positive affect condition would show improved performance (i.e., higher fluency and novelty scores) on the divergent thinking creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the neutral affect condition, consistent with prior research (Baas et al., 2008).

The second hypothesis was composed of two parts. Hypothesis 2a predicted that participants in the humor condition would show improved performance (i.e., higher fluency and novelty scores) on the divergent creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the neutral condition. Hypothesis 2b predicted that participants in the humor condition would show improved performance (i.e., higher fluency and novelty scores) on the divergent creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the positive affect condition.

First, fluency was examined across conditions with a one-way MANOVA. Condition served as the independent variable and fluency scores for both the unusual uses task and the product improvement task were entered as dependent variables. There was a significant multivariate main effect of condition, Pillai's (4, 172) = 2.68, $p = .034$, $\eta_p^2 = .06$. Univariate results showed a main effect of condition for the unusual uses task, $F(2, 86) = 3.86$, $p = .025$, $\eta_p^2 = .08$, as well as the product improvement test, $F(2, 86) = 5.22$, $p = .007$, $\eta_p^2 = .11$ (see Figure 1).

Figure 1

Number of Ideas Participants Generated for Divergent Creativity Tasks (Study One)



Note. Error bars represent standard errors.

To further investigate the relationship between condition and each of the divergent creativity (i.e., fluency) measures, a Roy-Bargmann stepdown analysis was conducted on the prioritized variables. In the stepdown analysis the highest priority variable is tested in a univariate analysis of variance and each of the remaining variables are analyzed in turn with a univariate analysis of covariance where the higher-priority measures serve as covariates. The assumption of homogeneity of regression was satisfied for all components of the stepdown analyses. Additionally, the familywise error rate of .05 was maintained by using a Bonferroni adjusted per-comparison significance level of .025. Unusual uses fluency was considered the highest priority dependent variable (i.e., most prominent in the literature) and was analyzed first.

Fluency scores for the unusual uses task differed significantly as a function of condition, $F(2, 86) = 3.86$, $p = .025$, $\eta_p^2 = .08$. Post hoc Bonferroni tests indicated that fluency scores were significantly higher in the positive condition ($M = 9.93$) compared to the neutral condition ($M = 6.75$), but not the humor condition ($M = 8.21$). After differences in unusual uses fluency was accounted for, there were no differences in product improvement fluency scores among the three groups of condition, $F(2, 85) = 1.68$, $p = .193$, $\eta_p^2 = .04$ (adjusted means: positive = 7.24, humor = 6.31, neutral = 5.32).

Next, a series of one-way ANOVAs were conducted with condition as the independent variable and novelty scores for the unusual uses and product improvement tests entered as the dependent variables. There was no main effect of condition seen for either the unusual uses test, $F(2, 86) = 2.14$, $p = .123$, $\eta_p^2 = .05$, nor for the product improvement test, $F(2, 86) = .73$, $p = .484$, $\eta_p^2 = .02$ (descriptive statistics for each creativity measure are presented in Table 11).

Finally, to test if the presence of the emotion scale interfered with creativity scores, a series of independent *t*-tests were conducted. The independent variable was whether participants received the post-emotion scale (1) or not (0). The dependent variables were the creativity tests. There were no differences in scores for unusual uses fluency, $t(87) = 1.64$, $p = .105$, unusual uses novelty, $t(87) = 1.33$, $p = .186$, product improvement novelty, $t(87) = -.92$, $p = .358$, or remote associate total scores, $t(86) = -.93$, $p = .353$; however, there was a difference for product improvement fluency, $t(87) = 2.55$, $p = .021$, and anagram total scores, $t(83) = -2.11$, $p = .038$ (see Table 12 for descriptive statistics). Participants listed more ideas for the product improvement test when moving immediately on to the creativity tasks ($M = 7.78$, $SD = 6.77$) compared to those who stopped to fill out the post-emotion measure ($M = 5.02$, $SD = 3.04$).

Conversely, participants solved more anagrams when they stopped for the emotion measure (M = 6.79, SD = 3.49) rather than moving immediately to the creativity tasks (M = 5.11, SD = 3.86).

Hypotheses 4a and 4b

Hypothesis 4 used subscales from the TIPI to score individuals along the personality dimensions of extraversion and openness to experience.

Hypothesis 4a predicted that those who scored higher on openness to experience and who were in the positive and humor conditions were expected to perform better on the divergent creativity tasks.

Hypothesis 4b predicted that those who scored higher on extraversion and who were in the positive and humor conditions were expected to perform better on the divergent creativity tasks.

To test these hypotheses, a series of moderated regressions were conducted using PROCESS with each personality trait as the predictor, each creativity task as the outcome, and mood condition as the moderator. The familywise error rate of .05 was maintained by using a Bonferroni adjusted per-regression significance level of .00625 (i.e., eight separate regressions). Table 13 presents the intercorrelations among the predictors and outcome variables. Table 14 presents the descriptive statistics for the predictors and outcome variables.

To test hypothesis 4a, four separate moderated regressions were conducted with openness as the predictor, condition as the moderator, and the four divergent creativity variables as the outcomes (i.e., unusual uses fluency, product improvement fluency, unusual uses novelty, product improvement novelty). Openness was centered in each regression. None of the regressions revealed a significant overall model at the adjusted significance level; however, there was a developing relationship between openness and product improvement fluency. Participants

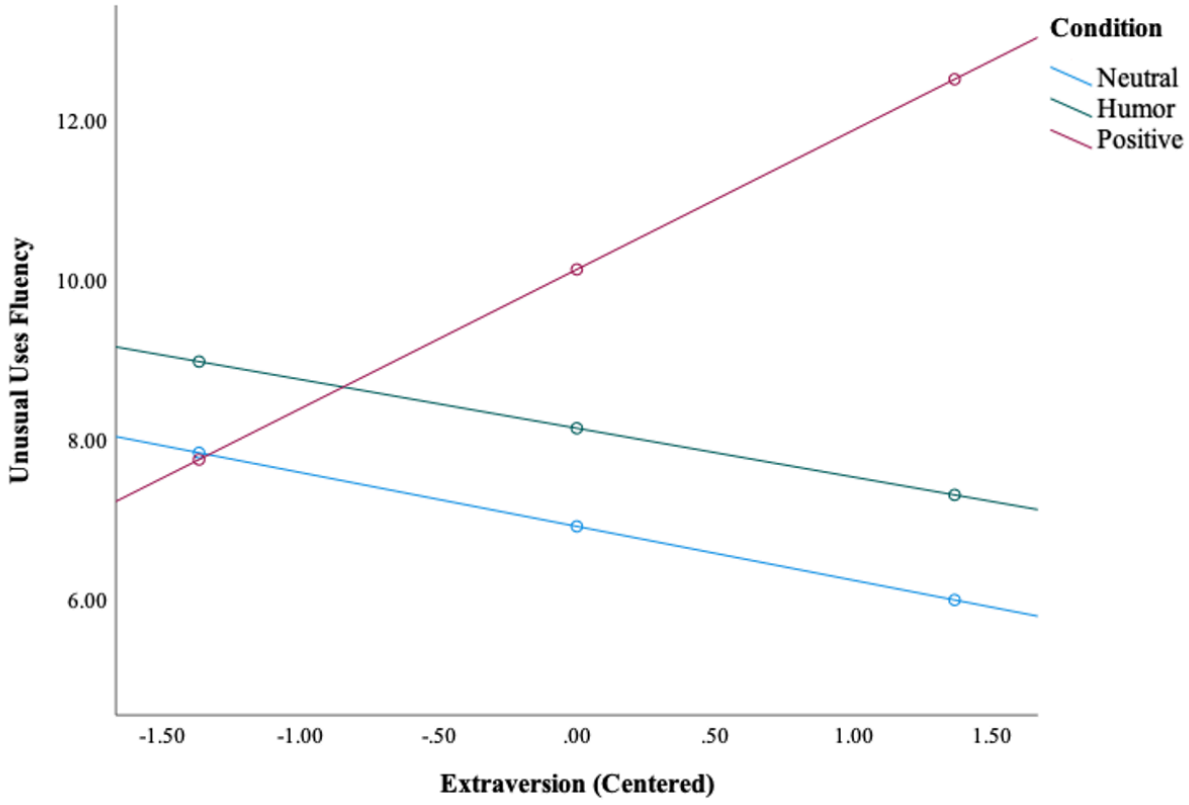
tended to generate more ideas for the product improvement task when they were higher on openness to experience and in the positive condition. See Table 15 for complete regression results.

To test hypothesis 4b, four separate moderated regressions were conducted with extraversion as the predictor, condition as the moderator, and the four divergent creativity variables as the outcomes. Extraversion was centered in each regression.

The overall model was significant when extraversion was regressed on unusual uses fluency scores and condition, $R = .44$, $R^2 = .19$, $F(5, 80) = 3.78$, $p = .004$. There was a significant difference in fluency scores between the positive ($M = 9.93$) and neutral ($M = 6.75$) condition, $b = 3.22$, $t(80) = 2.83$, $p = .006$. There was also a significant interaction between the positive and neutral condition by extraversion, $b = 2.42$, $t(80) = 2.91$, $p = .005$. The addition of the interaction accounted for a significant additional proportion of variance in fluency scores, $\Delta R^2 = .11$, $F_{inc} = 5.37$, $p = .007$. Examination of the simple slopes revealed that extraversion significantly predicted fluency scores in the positive condition, $b = 1.74$, $SE = .60$, $t(80) = 2.92$, $p = .005$, but not in the humor, $b = -.61$, $SE = .60$, $t(80) = -1.01$, $p = .315$, or neutral, $b = -.67$, $SE = .58$, $t(80) = -1.16$, $p = .249$, condition (see Figure 2; see Table 16 for complete regression results. No other models yielded significant results; however, there was a developing relationship between extraversion and product improvement fluency. Participants tended to generate more ideas for the product improvement task when they were more extraverted and in either the positive or humor condition. See Table 17 for correlations among mood, personality, and creativity.

Figure 2

Moderating Effect of Condition on Unusual Uses Fluency (Study One)



Study One Discussion

The purpose of study one was to replicate the positive mood effect found in previous research. Divergent creativity scores were expected to be higher for individuals who were in the positive mood condition compared to the intended mood-neutral control. This idea was tested with hypothesis one and was supported for the fluency dimension of divergent thinking. Individuals in the positive mood condition generated significantly more ideas for the unusual uses and product improvement task relative to the neutral condition, but the ideas generated from these tasks were not more novel.

Another purpose was to test whether comedy provided a creative advantage relative to a positive mood as well as to a mood-neutral control. This idea was tested with hypothesis two and was not supported for any of the dimensions for divergent creativity. As stated earlier, no known research studies have intentionally tested humor against positive mood on creative output. However, researchers have found positive mood in the form of humor to increase creativity relative to a mood-neutral control (Filipowicz, 2006; Hirt et al., 1997; Isen et al., 1987; Kline et al., 1990). The discrepancy between the results of this study and past research may be due either to the fact that in prior studies amusement was induced with a comedy film instead of pictures and the photos did not induce proper separation of emotional states across conditions, or there was not sufficient power to detect this difference. Study two used the same set of picture manipulations for the positive, humor, and neutral conditions, but added an irony condition to test if a different type of humor may boost creative performance in a way not detected in study one.

Finally, hypothesis 4a was not supported, but hypothesis 4b was partially supported. Openness has a long-standing relationship to creativity, making the null results found in this study surprising, but those higher in extraversion and who were in the positive condition did perform better than individuals in the other conditions. The absence of significant findings for openness and any of the divergent creativity outcomes regardless of condition again could be attributed to a power issue, or it could also be due to distractions that can accompany online research. These same regressions are run with the samples from study two and three for further insight on these findings.

Results from the manipulation checks did indicate that feelings of happiness were effectively induced within the positive condition and feelings of amusement were effectively

induced within the humor condition. Change scores for happiness were strongest in the positive condition, followed by the humor condition, but change scores for amusement were strongest in the positive condition as well (followed by the humor condition). While this study attempts to separate amusement from positive mood, and photos included in the positive set were rated lowest for humorousness in the picture selection studies, these results raise a question about possible unintentional confounding of feelings of amusement within the positive condition.

The new set of photos for the neutral condition were still not rated as more boring, but they did show the smallest change score for boredom compared to the other conditions and the post-emotion boredom score was highest for the neutral condition (albeit these changes and differences were not significant). There was also slightly more variation in the post-boredom scores across conditions. Additionally, the post-emotion scale amusement score was lowest for the neutral condition. Therefore, while the new set of photos in the neutral condition still did not bring about the affective separation that was desired or anticipated, it did at least provide for better separation than seen previously. The same sets of photos used in this study were thus used in the studies that follow.

Study Two

The purpose of study two was to replicate and extend the significant findings from study one. In addition to replicating the positive mood effect found for fluency, another purpose was to test whether general comedy, and in particular, ironic humor, aids performance on certain creative tasks relative to general positive mood, as well as to a mood-neutral control.

That is, study two aimed to discover if there were any differences in creative performance on different types of creativity tasks (i.e., divergent vs. convergent) as a function of mood induction. This is because different moods may provide performative enhancement on certain

tasks because they reflect the use of either a cognitive or an affective pathway. That is, positive mood is thought to improve creative performance through an affective pathway and be more beneficial to divergent tasks, while irony is thought to improve creative performance through a cognitive pathway and be more beneficial to both types of creative tasks. Understanding an ironic statement is more cognitively effortful, but irony can also contain humorous themes that may improve mood as well as force the individual to hold opposing information simultaneously and use abstract thinking which is beneficial to both types of creative thinking (Barron & Harrington, 1981; Csikszentmihalyi, 1996; Huang, 2020; Koestler, 1964; McDonald, 1999).

Method

Participants

The sample was composed of individuals recruited from the University of Texas at Arlington's Psychology Department participant pool (SONA). A total of 209 participants were recruited from the student pool. Eligibility required the participant to be at least 17 years of age or older, be currently enrolled as a student at the University of Texas at Arlington, and to speak English. Data screening was conducted and 29 (14%) were excluded due to not completing the creativity tasks at all (n = 5), poor quality data (n = 7), unsatisfactory performance on the memory test (n = 9), or upon reviewing the database after data collection concluded, a mistake in the idea ratings was discovered (n = 8). The remaining sample size was 180 participants. In exchange for completing the study, each participant was granted .5 research credits. Individuals were primarily female (62.8%) and Hispanic/Latino(a) (37.8%), ranging in age from 17 to 49 (M = 20.47, SD = 3.67). There were 43 participants in the positive condition, 49 in the humor condition, 44 in the neutral condition, and 44 in the irony condition. See Table 18 for complete demographics.

Experimental Design

This was a 4 (mood: positive vs. amused vs. neutral vs. irony) x 4 (creativity task: unusual uses test vs. product improvement test vs. remote associates test vs anagrams) mixed experimental design measuring the influence of moods on divergent and convergent creativity. Condition (i.e., mood) served as the between-subjects variable, while the creativity tasks served as the within-subjects dependent variables.

Measures and Materials

Through the course of their participation, individuals completed a personality and humor styles assessment, baseline emotion measure, viewed a set of 10 photos, completed a post-manipulation emotion measure (50%), four creativity tasks, a memory task, and a demographics section.

Ten-Item Personality Inventory

The Ten-Item Personality Inventory (TIPI; Gosling et al., 2003) was completed before the creativity tasks. This personality assessment is based on the Big-Five personality domains and was created for situations where brief measures of personality are desired. Participants respond on a scale from 1 (*Disagree strongly*) to 7 (*Agree strongly*). An example item is, "Extraverted/enthusiastic." Test-retest reliability of this measure averages at .72 and is shown to have adequate convergent and discriminant validity compared to the Big-Five Inventory (Gosling et al., 2003; John & Srivastava, 1999).

Humor Styles Questionnaire

The Humor Styles Questionnaire (Martin et al., 2003) was added to this survey to explore the relationships among various styles of humor and the creativity tasks measured in this study. Participants answered eight questions for each of the four humor styles (32 questions total) on a

1 (*completely disagree*) to 7 (*completely agree*) scale. Answers to each question respective to each style are then summed. Reliability analyses for each sub-scale report Cronbach alphas ranging from .82 to .88.

Emotion Measure

All participants completed the same baseline emotion measure as the pilot study and study one. This measure asked participants to select the number that best described how they felt at this moment using a response range of 1 (*very slightly or not at all*) to 5 (*extremely*) for the dimensions of happy, amused, bored, upset, and confused.

Likewise, a second identical post-manipulation emotion measure was randomized to appear to half of the sample.

Mood Manipulations

Participants in each condition viewed 10 photos designed for their respective mood induction condition (i.e., positive, humor, neutral, irony). Each picture within each condition was displayed for 12-seconds, in the same order across participants, with the intention to standardize exposure to the visual stimuli.

The same photos used in study one for the positive, humor, and neutral conditions were also used in the positive, humor, and neutral conditions here for study two.

Positive. The ten photos selected for the positive condition depicted images with wholesome themes such as happy animals and positive messages.

Humor. Photos selected for the humor condition depicted images with light-hearted themes, also including photos of some animals, but presented in a more purposefully humorous manner.

Neutral. Photos selected for the neutral condition depicted images that were based on their low score for the boring dimension on the revised picture selection survey (the lower anchor was *very boring* and the higher anchor was *very interesting*).

Irony. Photos were selected for the irony condition based on the data from the revised picture stimuli survey discussed after the pilot study. These photos were selected based on their high score for the sarcasm/irony dimension on the survey. The intention of this set of photos was to induce humor while also stimulating the cognitive processing inherent in irony.

Creativity Tasks

Participants were asked to complete the same four creativity tasks as in Study one. Each task was displayed one at a time, for five minutes, in a random order.

Unusual Uses. Participants were asked to "please list all the uses you can think of for a paperclip" and enter those ideas into a textbox on QuestionPro. This task was scored for fluency and originality (i.e., novelty) by trained raters.

Product Improvement. Participants were presented with a picture of a stuffed elephant and asked to "please list the cleverest, most interesting and unusual ways you can think of to change the toy elephant pictured above so that it is more fun to play with" and enter those ideas into a textbox on QuestionPro. This task was scored by trained raters for fluency and originality.

Remote Associates Test. Participants were given 17 sets of three words where they responded by entering into a textbox the word they believe is the associate.

Anagrams. Participants were presented with 13 six-letter single- or double-solution anagrams which participants were asked to solve by entering their answer in a textbox below each scrambled word.

Memory Task

Participants were presented with the same memory task as described in the pilot study. Individuals were presented with 10 pictures and asked to select which photos they saw at the beginning of the study. Half were pictures from their own condition and half were from a pool of extra photos not presented in any other condition.

Demographics

Participants completed questions asking about their age, gender, race, and if English was their first language. In addition, they were asked to write what they believed the purpose of this study was, as well as select an option indicating how interested they were in the photos shown to them earlier.

Procedure

The procedure for this study was identical to that of study one, except for the addition of the irony condition for the mood manipulation. That is, instead of three affect conditions (i.e., positive, humor, neutral) there were four (i.e., positive, humor, neutral, irony). The remaining aspects of the procedure were the same.

Data were collected using the online data collection software QuestionPro. Participants were recruited from the University of Texas at Arlington's Psychology Department participant pool (SONA). Only participants who were 17 years of age or older and spoke English were eligible to participate. The survey in its entirety took approximately 35 minutes to complete.

After providing electronic informed consent, participants were asked to complete the TIPI, followed by the HSQ, and subsequently the emotion measure. Next, participants were randomly assigned to one mood condition (selected by the QuestionPro randomizer) in which they viewed a set of 10 pictures, presented in a uniform order, and shown individually for 12-

seconds. Following the mood manipulation, a random 50% selection of participants completed a second emotion measure (selected by the QuestionPro randomizer).

All participants were then asked to complete four creativity tasks (i.e., unusual uses, product improvement, remote associates, anagrams; order randomized through QuestionPro). Each task was time-capped and restricted at five-minutes, meaning participants could not move forward before the timer reached zero. Once the five-minutes was reached the page automatically progressed to the next creativity task. Therefore, a total of 20-minutes was allotted for creative idea generation and/or problem-solving.

After the creativity tasks, participants completed the memory task, followed by a short demographics section. The study concluded with an electronic debriefing about the true nature of the study. At any point, participants retained the freedom to withdraw from the study with partial credit and without penalty; however, there were no such requests. Likewise, at the time of the debriefing, participants could elect to exclude their data from analyses; no such requests were received.

Data were analyzed using IBM's Statistical Package for the Social Sciences (SPSS, v. 27) as well as the PROCESS (Hayes, 2020) macro.

Study Two Results

Data Cleaning and Coding

Prior to running the main analyses, the data were checked for missing values as well as univariate and multivariate normality and outliers (even though MANOVA is considered robust to non-normality when there are at least 20 cases in the smallest cell; Mardia, 1971; Seo et al., 1995; Tabachnick & Fidell, 2007). Independence was ensured as much as possible by the

random sampling and random assignment to experimental conditions; likewise, the creativity tasks were presented in random order.

Results of the evaluation for normality, outliers, linearity, multicollinearity, and homogeneity of variance, and homogeneity of variance-covariance matrices were satisfactory. *F* tests tend to be robust to modest violations and generally have minimal influence if the groups are relatively equal (i.e., $N_{\text{humor (largest group)}} = 49 \div N_{\text{positive (smallest group)}} = 43 < 1.5$; Hair et al., 2013) so the assumptions were considered to be satisfied. For the moderated regressions, inspection of influential observations revealed cases that, when excluded, did not change overall interpretations. Therefore, these individuals remained in the analyses.

A team of 10 trained undergraduate raters provided novelty ratings for both the unusual uses and product improvement tasks. Four of these raters provided ratings for the ideas from the unusual uses test and six provided ratings for the ideas from the product improvement test. Additionally, 86% of the total ideas were rated first, followed by the remaining 14% at a later date. Reliability for the unusual uses test for the first (*ICC* = .82) and second set (*ICC* = .76) were considered acceptable. Likewise, reliability for the product improvement test for the first (*ICC* = .83) and second set (*ICC* = .78) were also considered acceptable (Nunnally, 1978; Taber, 2018).

Fluency was scored by the author who was, at the time, blind to each participant's condition. Participant responses were separated by identifying unique ideas within their submission and subsequently counting those responses relevant to the task. Ideas that were overtly not on-task were excluded from the counts. For example, responses such as, "honestly nothing else comes to mind I'm sorry" were not counted.

The RAT and anagram tasks were scored by the author as well. Scores of "1" (i.e., correct response) or "0" (i.e., incorrect response) were assigned to each person according to their respective response to each item of each task. These scores were then summed to obtain total correct scores for each convergent task.

Correlations were run to assess the relationships among the dependent variables for inclusion in the MANOVA. There was a moderate association between fluency, $r(178) = .49$, $p < .001$, $r^2 = .24$, and novelty scores, $r(178) = .40$, $p < .001$, $r^2 = .16$, between the unusual uses and product improvement tasks; but a low association between anagram and remote associate test scores, $r(178) = .18$, $p = .015$, $r^2 = .03$. See Table 19 for complete matrix.

Manipulation Checks

Emotion Scale

To establish a baseline, all participants were given the emotion scale measuring feelings of happiness, amusement, boredom, upset, and confusion prior to viewing the pictures in their respective mood condition. The survey was constructed to present the same emotion scale after the mood manipulation to a random 50% subset.

As the mood manipulations for the positive, humor, and neutral conditions were decently effective for study one, and study two uses the same photos for each of those three conditions, only the mood change for the irony condition was examined[1]. A paired-samples *t*-test was conducted to assess whether participants in the humor and irony condition were more amused after viewing the photos in their condition. There was a significant increase in feelings of amusement for those in the humor condition, $t(48) = 6.26$, $p < .001$, from time one ($M = 2.57$, $SD = 1.02$) to time two ($M = 3.57$, $SD = 1.12$), as well as the irony condition, $t(43) = 5.66$, $p < .001$,

[1]Unfortunately, a QuestionPro survey error prevented the comparison of the other emotion scale dimensions within the other conditions; everyone in the humor and irony conditions received the post-emotion scale while no one in the positive and neutral received it.

from time one (M = 2.59, SD = 1.19) to time two (M = 3.55, SE = 1.11), suggesting the manipulation was effective (see Table 20).

Memory Test

After completing the creativity tasks, participants were presented with a set of 10 photos and told to select the photos they remember seeing in their respective mood manipulation. There were five previously shown pictures presented in the same pattern for each version of this task.

Most participants performed well, with 95% of the sample selecting at least four or more of the correct pictures and 78.8% selecting only and all of the correct pictures; however, five individuals selected only three of the correct photos, two individuals selected only one, and one individual selected zero correct photos. These nine individuals were excluded from the main analyses due to their disproportionately poor performance.

Hypotheses

Hypotheses tested in study two included hypothesis 1, 2a, 2b, 3a, 3b, 4a and 4b. A familywise significance level of .05 was used for all analyses.

Hypotheses 1, 2a, 2b, 3a, and 3b

The first second, and third hypotheses were tested by conducting a series of ANOVAs with various divergent outcomes from the unusual uses and product improvement data as well as the convergent outcomes from the RAT and anagram tasks.

The first hypothesis was that participants in the positive affect condition would show improved performance (i.e., higher fluency and novelty scores) on the divergent thinking creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the neutral affect condition, consistent with prior research (Baas et al., 2008).

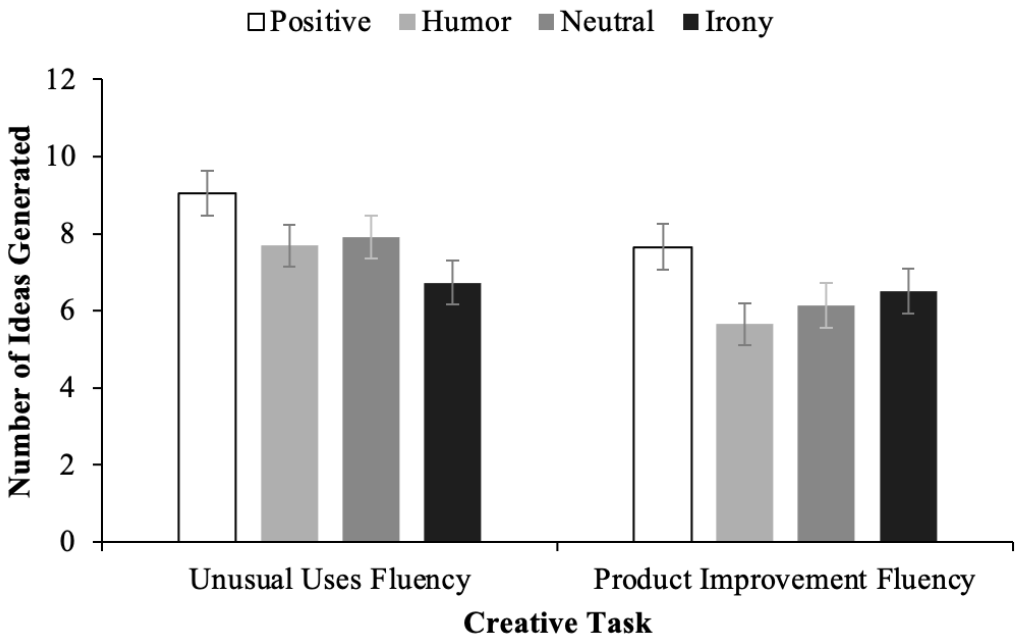
The second hypothesis was composed of two parts. Hypothesis 2a predicted that participants in the humor condition would show improved performance (i.e., higher fluency and novelty scores) on the divergent creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the neutral condition. Hypothesis 2b predicted that participants in the humor condition would show improved performance (i.e., higher fluency and novelty scores) on the divergent creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the positive affect condition.

The third hypothesis was also composed of two parts. Hypothesis 3a predicted that participants in the ironic condition would show improved performance on both the divergent (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks) and convergent (i.e., higher total scores on the Remote Associates Test and anagram tasks) creativity tasks compared to those in the neutral condition. Hypothesis 3b predicted that participants in the ironic condition would show improved performance on both the divergent (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks) and convergent (i.e., higher total scores on the Remote Associates Test and anagram tasks) creativity tasks compared to those in the humor condition.

First, fluency was examined across conditions with a one-way MANOVA. Condition served as the independent variable and fluency scores for both the unusual uses task and the product improvement task were entered as dependent variables. The MANOVA showed a significant multivariate main effect of condition, Wilks' $(6, 352) = 2.28$, $p = .036$, $\eta_p^2 = .04$. Univariate results showed a main effect for unusual uses fluency scores, $F(3, 176) = 2.79$, $p = .042$, $\eta_p^2 = .05$, but not product improvement, $F(3, 176) = 2.16$, $p = .094$, $\eta_p^2 = .04$ (see Figure 3).

Figure 3

Number of Ideas Participants Generated for Divergent Creativity Tasks (Study Two)



Note. Error bars represent standard errors.

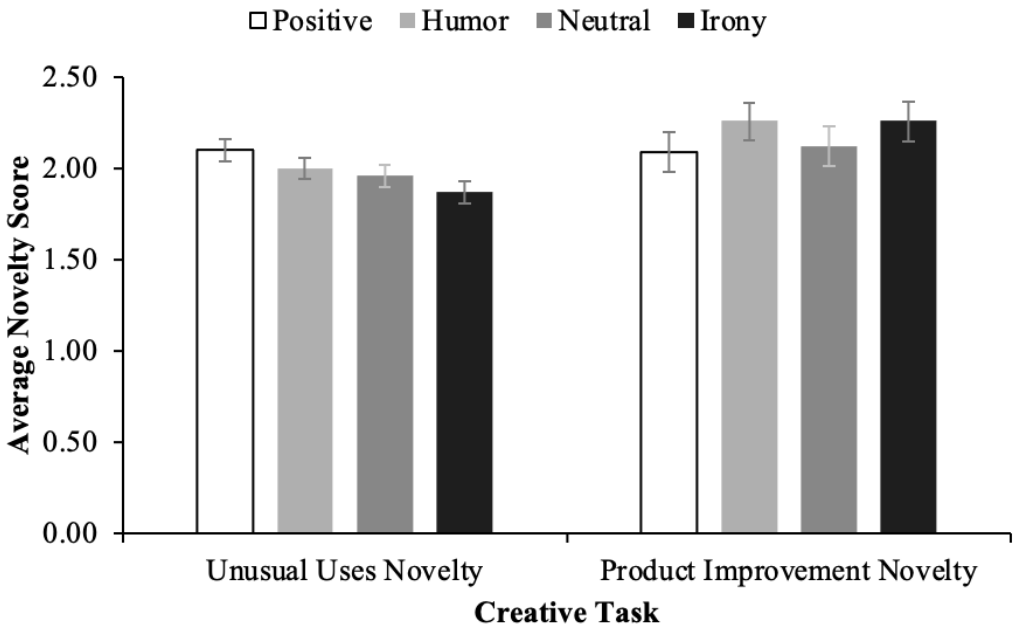
To further investigate the relationship between condition and each of the divergent creativity (i.e., fluency) measures, a Roy-Bargmann stepdown analysis was conducted. The assumption of homogeneity of regression was satisfied for all components of the stepdown analyses. Additionally, the familywise error rate of .05 was maintained by using a Bonferroni adjusted per-comparison significance level of .025. Unusual uses fluency was again considered the highest priority dependent variable and was analyzed first. Fluency scores for the unusual uses task did not differ significantly as a function of condition, $F(3, 176) = 2.79$, $p = .042$, $\eta_p^2 = .05$, but the highest number of ideas generated were by those in the positive condition ($M = 9.05$), followed by the neutral condition ($M = 7.91$), the humor condition ($M = 7.69$), and finally

the irony condition (M = 6.73). Likewise, after differences in unusual uses fluency were accounted for, there were no differences in product improvement fluency scores among the four groups of condition, $F(3, 175) = 1.79$, $p = .150$, $\eta_p^2 = .03$ (adjusted means: positive = 7.05, humor = 5.72, neutral = 6.10, irony = 7.05).

Next, novelty was examined across conditions with a one-way MANOVA. Condition served as the independent variable and novelty scores for both the unusual uses task and the product improvement task were entered as dependent variables. The MANOVA showed a significant multivariate main effect of condition, Wilks' $(6, 350) = 2.41$, $p = .027$, $\eta_p^2 = .04$. Univariate results showed neither a main effect for unusual uses novelty scores, $F(3, 176) = 2.60$, $p = .054$, $\eta_p^2 = .04$, or product improvement, $F(3, 176) = .70$, $p = .554$, $\eta_p^2 = .14$ (see Figure 4).

Figure 4

Average Novelty for Ideas Generated from Divergent Creativity Tasks (Study Two)



Note. Error bars represent standard errors.

To further investigate the relationship between condition and each of the divergent (i.e., novelty) measures, a Roy-Bargmann stepdown analysis was conducted. The assumption of homogeneity of variance was satisfied for all components of the stepdown analyses. Additionally, the familywise error rate of .05 was maintained using a Bonferroni adjusted per-comparison significance level of .025. Unusual uses novelty was considered the highest priority dependent variable and was analyzed first. Novelty scores for the unusual uses task did not differ significantly as a function of condition, $F(3, 176) = 2.60$, $p = .054$, $\eta_p^2 = .04$ (means: positive = 2.10, humor = 2.00, neutral = 1.97, irony = 1.87). Likewise, after differences in unusual uses novelty were accounted for, there were no differences in product improvement novelty scores among the four groups of condition, $F(3, 175) = 2.24$, $p = .085$, $\eta_p^2 = .04$. (adjusted means: positive = 2.00, humor = 2.25, neutral = 2.14, irony = 2.35).

Finally, convergent creativity scores were examined across conditions with a one-way MANOVA. Condition served as the independent variable and convergent scores for the anagram and RAT were entered as dependent variables. The MANOVA did not show a significant multivariate main effect of condition, Wilks' (6, 350) = .45, $p = .844$, $\eta_p^2 = .01$. Univariate results likewise did not show a main effect of condition for either the RAT, $F(3, 176) = .33$, $p = .800$, $\eta_p^2 = .01$, or anagram task, $F(3, 176) = 71$, $p = .550$, $\eta_p^2 = .01$ (descriptive statistics presented in Table 21).

Finally, to test if the presence of the emotion scale interfered with creativity scores, a series of independent *t*-tests were conducted. The independent variable was whether participants received the post-emotion scale (1) or not (0). The dependent variables were the creativity tests. There were no differences in scores for unusual uses novelty, $t(178) = 1.56$, $p = .120$, product

improvement fluency, $t(178) = 1.43$, $p = .155$, product improvement novelty, $t(178) = -1.44$, $p = .153$, anagram total scores, $t(178) = 1.32$), $p = .188$, or remote associate total scores, $t(178) = .95$, $p = .344$; however, there was a difference for unusual uses fluency, $t(178) = 2.19$, $p = .030$ (see Table 22 for descriptive statistics). Participants listed more ideas for the unusual uses test when moving immediately on to the creativity tasks ($M = 8.47$, $SD = 3.88$) compared to those who stopped to fill out the post-emotion measure ($M = 7.24$, $SD = 3.67$).

Hypotheses 4a, 4b, and 4c

Hypothesis four used subscales from the TIPI to score individuals along the personality dimensions of extraversion, openness to experience, and conscientiousness.

Hypothesis 4a predicted that those who scored higher on openness to experience and who were in the positive and humor conditions were expected to perform better on the divergent creativity tasks.

Hypothesis 4b predicted that those who scored higher on extraversion and who were in the positive and humor conditions were expected to perform better on the divergent creativity tasks.

Hypothesis 4c predicted that those who scored higher on conscientiousness and who were in the irony condition were expected to perform better on the convergent creativity tasks.

To test these hypotheses, a series of moderated regressions were conducted in PROCESS with each personality trait as the predictor, each creativity task as the outcome, and mood condition as the moderator. The familywise error rate of .05 was maintained by using a Bonferroni adjusted per-regression significance level of .005 (i.e., 10 separate regressions). Table 23 presents the intercorrelations among the predictors and outcome variables.

To test hypothesis 4a, four separate moderated regressions were conducted with openness as the predictor, condition as the moderator, and the four divergent creativity variables as the outcomes (i.e., unusual uses fluency, product improvement fluency, unusual uses novelty, and product improvement novelty). Openness was centered in each regression. None of the regressions revealed a significant overall model at the adjusted significance level; however, there was a developing relationship between openness and unusual uses fluency. Participants who scored higher on openness to experience tended to generate more ideas for the unusual uses task regardless of condition, but those in the positive condition performed the best.

To test hypothesis 4b, four separate moderated regressions were conducted with extraversion as the predictor, condition as the moderator, and the five divergent creativity variables as the outcomes. Extraversion was centered in each regression. None of the regressions revealed a significant overall model at the adjusted significance level.

To test hypothesis 4c two separate moderated regressions were conducted with conscientiousness as the predictor, condition as the moderator, and the two convergent creativity variables as the outcomes (i.e., RAT, anagrams). Conscientiousness was centered in each regression. Neither of the regressions revealed a significant overall model at the adjusted significance level. See Table 24 for complete regression results. See Table 25 for correlations among mood, personality, and creativity.

Study Two Discussion

The purpose of study two was to replicate and extend the significant findings from study one. Divergent creativity scores were expected to be higher for individuals who were in the positive mood condition compared to the neutral condition as seen in study one, but the results

for study two did not replicate this finding. The MANOVAs did reveal significant multivariate effects for composite fluency and composite novelty, but upon examination of the means it was discovered these effects were driven by the difference between the positive and irony conditions. Consistent with expectations, those in the positive condition generated the most ideas as well as the most novel ideas. Contrary to expectations, this was only different compared to those in the irony condition who exhibited the lowest divergent creative performance.

Another purpose of study two was to test if general comedy, and in particular, ironic humor, aided performance on certain creative tasks relative to general positive mood, as well as to a mood-neutral control. In particular, it was expected that individuals who were in the positive condition would perform better on the divergent creativity tasks compared to a mood neutral control, and this would be attributed to the increase in feelings of happiness brought about by the positive picture set. It was also expected that individuals who were in the humor condition would perform better on the divergent creativity tasks compared to those in the positive condition due to the anticipated boost in the combined feelings of happiness and amusement brought about by the humorous picture set. Further, it was expected that individuals who were in the irony condition would perform better on divergent and convergent creativity tasks compared to those in the neutral condition as well as those in the humor condition. The picture sets in the positive and humor conditions were predicted to increase divergent creative output through an affective pathway, while the ironic picture set was predicted to increase both divergent and convergent creative output through a cognitive pathway.

The results of study two indicated that none of the predicted hypotheses were supported (i.e., Hypotheses 1, 2a, 2b, 3a, 3b, 4a, 4b, 4c). The null results for hypotheses 2a, 2b, 4a, and 4b are consistent with the findings from study one, but the fact that the positive mood effect (i.e.,

Hypothesis one) was not replicated in study two was surprising. Another surprising finding was that creativity scores were consistently the lowest for individuals in the ironic condition (even worse than those seen in the neutral condition) despite a seemingly effective affect induction of amusement.

The reasons behind these null findings may again be attributed to a power issue (as the sample was somewhat smaller than what the power analysis indicated was necessary), to the unknown presence of distractions while participants were completing the online survey, or to the picture affect induction not inducing proper separation of emotional states across conditions.

In particular, the low performance in the irony condition could potentially be due to the ironic stimuli potentially requiring more cognitive resources to process, leaving fewer resources available for the creativity tasks. Further, it could also be due to the lack of significant change in reported happiness after viewing the ironic photos.

Unfortunately, there was a QuestionPro randomization error for the post-emotion scale which severely limited the ability to calculate changes in emotional states along the proper dimensions before and after the picture manipulation, as well as to compare those changes and post-emotion scale scores across conditions. Study three was then conducted to test the emotional effectiveness of each picture set with a new sample, as well as to test if actively thinking about the intended emotion for each picture in each set would increase each respective affective state and consequently creative output.

Study Three

Study three aimed to replicate and extend the significant positive mood effect from study one. Another purpose of study three was to re-test the affective effectiveness of the picture manipulations and hypotheses from study two. The same picture manipulations were used as in

study two. However, study three also included an explanation condition for each picture condition.

Study three builds upon studies one and two by adding a more cognitively attentive component to the picture manipulations. Instead of passively viewing each picture in their respective conditions, some participants were additionally asked to describe why each photo may promote feelings respective to those conditions. The rationale for this experimental addition was to discern if a deeper level of processing for each photo enhances mood congruent processing and consequently creative output (i.e., if thinking about why a humorous meme is funny will enhance creative performance over simple enjoyment and understanding).

Study Three Method

Participants

The sample was composed of individuals recruited from Prolific, an online survey recruitment platform. There were a total of 299 original cases in the database; however, 36 were removed (12%) because participants either did not complete the survey in its entirety (n = 1), upon cleaning the data the response was found to be of poor quality (n = 23), or they scored three or less on the memory test (n = 12). This left a sample of 263 participants in total for analysis.

In exchange for completing the study, each participant was compensated $3.50 USD. Individuals were primarily female (63.9%) and Caucasian (71.1%), ranging in age from 18 to 75 (M = 31.94, SD = 12.76). There were 65 participants in the positive condition (31 in positive explain), 65 in the humor condition (28 in humor explain), 68 in the neutral condition (31 in neutral explain), and 65 in the irony condition (34 in irony explain). See Table 26 for complete demographics.

Experimental Design

This was a 4 (mood: positive vs. amused vs. neutral vs. irony) x 2 (creativity task: unusual uses test vs. product improvement test) x 2 (explain: explanation-present vs. explanation-absent) mixed experimental design measuring the influence of moods on divergent creativity. Condition (i.e., mood) and explanation served as the between-subjects variables, while the creativity tasks served as the within-subjects dependent variables.

Measures and Materials

Through the course of their participation, individuals completed a personality and humor styles assessment, baseline emotion measure, viewed a set of 10 photos, completed a post-manipulation emotion measure (50%), two creativity tasks, a memory task, and a demographics section.

Ten-Item Personality Inventory

The Ten-Item Personality Inventory (TIPI; Gosling et al., 2003) was completed before the creativity tasks. This personality assessment is based on the Big-Five personality domains and was created for situations where brief measures of personality are desired. Participants respond on a scale from 1 (*Disagree strongly*) to 7 (*Agree strongly*). An example item is, "Extraverted/enthusiastic." Test-retest reliability of this measure averages at .72 and is shown to have adequate convergent and discriminant validity compared to the Big-Five Inventory (Gosling et al., 2003; John & Srivastava, 1999).

Humor Styles Questionnaire

The Humor Styles Questionnaire (Martin et al., 2003) was added to this survey to explore the relationships among various styles of humor and the creativity tasks measured in this study. Participants answered eight questions for each of the four humor styles (32 questions total) on a

1 (*completely disagree*) to 7 (*completely agree*) scale. Answers to each question respective to each style are then summed. Reliability analyses for each sub-scale report Cronbach alphas ranging from .82 to .88.

Emotion Measure

All participants completed the same baseline emotion measure as the pilot study. This measure asked participants to select the number that best described how they felt at this moment using a response range of 1 (*very slightly or not at all*) to 5 (*extremely*) for the dimensions of happy, amused, bored, upset, and confused.

Likewise, a second identical post-manipulation emotion measure was randomized to appear to half of the sample.

Mood Manipulations

Participants in each condition viewed 10 photos designed for their respective mood induction condition (i.e., positive, humor, neutral, irony).

Each picture within each traditional condition was displayed for 12-seconds, in the same order to standardize exposure to the visual stimuli. The same photos used in study two for the positive, humor, neutral, and irony conditions were also used in the positive, humor, neutral, and irony conditions here for study three.

Positive. The ten photos selected for the positive condition depicted images with wholesome themes such as happy animals and positive messages.

Humor. Photos selected for the humor condition depicted images with light-hearted themes, also including photos of some animals, but presented in a more purposefully humorous manner.

Neutral. Photos selected for the neutral condition depicted images that were based on their low score for the boring dimension on the revised picture selection survey (the lower anchor was *very boring* and the higher anchor was *very interesting*).

Irony. Photos were selected for the irony condition based on the data from the revised picture stimuli survey discussed after the pilot study. These photos were selected based on their high score for the sarcasm/irony dimension on the survey. The intention of this set of photos was to induce humor while also stimulating the cognitive processing inherent in irony.

Explanation Manipulation

Study three used the same photos for each respective condition as in study two (i.e., positive, humor, neutral, irony), but also included a parallel set of photo stimuli where participants were asked to briefly explain the underlying affective theme within each respective condition. Photos shown in each corresponding condition were the same. For example, the same photos were shown in the positive and positive explain conditions. Each photo in the traditional conditions was displayed for 12-seconds, but each photo in the explanation conditions was displayed for 30-seconds, all in the same order. The purpose of increasing the allotted exposure for the explanation conditions was to allow enough time for participants to both read, understand, and write a short description.

Positive Explain. Participants were shown 10 photos which depicted images of wholesome themes such as happy animals and positive messages, but for each photo were additionally asked to, "Please briefly describe why this photo may be positive."

Humor Explain. Participants were shown 10 photos which depicted images with light-hearted themes, but for each photo were additionally asked to, "Please briefly describe why this photo may be humorous."

Neutral Explain. Participants were shown 10 photos rated as boring in the second pilot meme selection survey, but were additionally asked to, "Please briefly describe this photo."

Irony Explain. Participants were shown ten photos rated as sarcastic/ironic in the second pilot meme selection survey, but were additionally asked to, "Please briefly describe why this photo may be ironic (e.g., contains opposite or contrasting ideas)."

Creativity Tasks

Participants were asked to complete the same creativity tasks as in the pilot study. That is, as the convergent tasks (i.e., RAT, anagrams) consistently yielded null results, to condense the time necessary to complete the study (and consequently lower payments) participants only completed the divergent tasks (i.e., unusual uses, product improvement). Both tasks were still displayed one at a time, for five minutes, in a random order.

Unusual Uses. Participants were asked to "please list all the uses you can think of for a paperclip" and enter those ideas into a textbox on QuestionPro. This task was scored for fluency and originality (i.e., novelty) by trained raters.

Product Improvement. Participants were presented with a picture of a stuffed elephant and asked to "please list the cleverest, most interesting and unusual ways you can think of to

change the toy elephant pictured above so that it is more fun to play with" and enter those ideas into a textbox on QuestionPro. This task was scored by trained raters for fluency and originality.

Procedure

The procedure for this study was identical to that of study two, except for the elimination of the convergent creativity tasks and the addition of the four corresponding affective explanation conditions. The remaining aspects of the procedure were the same.

Data were collected using the online data collection software QuestionPro. Participants were recruited from Prolific, an online survey recruitment platform. Only participants who were 18 years of age or older, spoke English, and resided in the United States were eligible to participate. The survey in its entirety took approximately 30-minutes to complete.

After providing electronic informed consent, participants were asked to complete the TIPI, followed by the HSQ, and subsequently the emotion measure. Next, participants were randomly assigned to one mood condition (selected by the QuestionPro randomizer) in which they viewed a set of 10 pictures, presented in a uniform order, and shown individually for either 12-seconds (non-explanation conditions) or 30-seconds (explanation conditions). Following the mood manipulation, a random 50% selection of participants completed a second emotion measure (selected by the QuestionPro randomizer).

All participants were then asked to complete four creativity tasks (i.e., unusual uses, product improvement; order randomized through QuestionPro). Each task was time-capped and restricted at five-minutes, meaning participants could not move forward before the timer reached zero. Once the five-minutes was reached the page automatically progressed to the next creativity task. Therefore, a total of 10-minutes was allotted for creative idea generation and/or problem-solving.

After the creativity tasks, participants completed the memory task, followed by a short demographics section. The study concluded with an electronic debriefing about the true nature of the study. At any point, participants retained the freedom to withdraw from the study with partial credit and without penalty; however, there were no such requests. Likewise, at the time of the debriefing, participants could elect to exclude their data from analyses; no such requests were received.

Data were analyzed using IBM's Statistical Package for the Social Sciences (SPSS, v. 27) as well as the PROCESS (Hayes, 2020) macro.

Study Three Results

Data Cleaning and Coding

Prior to running the main analyses, the data were checked for missing values as well as univariate and multivariate normality and outliers (even though MANOVA is considered robust to non-normality when there are at least 20 cases in the smallest cell; Mardia, 1971; Seo et al., 1995; Tabachnick & Fidell, 2007). Independence was ensured as much as possible by the random sampling and random assignment to experimental conditions; likewise, the creativity tasks were presented in random order.

Results of the evaluation for normality, outliers, linearity, multicollinearity, and homogeneity of variance, and homogeneity of variance-covariance matrices were mostly satisfactory. *F* tests tend to be robust to modest violations and generally have minimal influence if the groups are relatively equal (i.e., $N_{\text{humor, neutral (largest group)}} = 37 \div N_{\text{humor explain (smallest group)}} = 28 < 1.5$; Hair et al., 2013) so the assumptions were considered to be satisfied. For the moderated regressions, inspection of influential observations revealed cases that, when excluded, did not change overall interpretations. Therefore, these individuals remained in the analyses.

A set of five trained undergraduate raters provided novelty ratings for the unusual uses task (*ICC* = .83) and two provided ratings for the product improvement tasks (*ICC* = .75). These reliability values were considered acceptable (Nunnally, 1978; Taber, 2018).

Fluency was scored by the author who was, at the time, blind to each participant's condition. Participant responses were separated by identifying unique ideas within their submission and subsequently counting those responses relevant to the task. Ideas that were overtly not on-task were excluded from the counts. For example, responses such as, "fluffy, furry, gray plush of cuteness" were not counted.

Correlations were run to assess the relationships among the dependent variables for inclusion in the MANOVA. There was a moderately large association between fluency $r(261) = .61$, $p < .001$, ,$r^2 = .37$ and a moderately weak association between novelty scores, $r(261) = .28$, $p < .001$, $r^2 = .08$. Therefore, for the main analyses a MANOVA was conducted with fluency and novelty variables entered as dependent variables (See Table 27 for complete matrix).

Answers to the explanation conditions were examined prior to data analysis to detect extraneous responses. After removing the poor memory and creativity performers, the remaining cases all appeared to provide responses relevant to participants' respective conditions.

Manipulation Checks

Emotion Scale

To establish a baseline, all participants were given the emotion scale measuring feelings of happiness, amusement, boredom, upset, and confusion prior to viewing the pictures in their respective mood condition. The survey was constructed to present the same emotion scale after the mood manipulation to a random 50% subset.

To assess the degree to which participants' moods changed as a result of viewing the pictures, a series of two-way mixed factors ANOVAs were conducted with affect condition (i.e., overall affective category) as the between-subjects variable, and with emotion scale scores before and after the mood manipulation serving as the within-subjects variable. Table 28 contains the means for each dimension on the emotion measure both before and after the mood manipulation, separated by overall condition.

A one-way MANOVA was initially conducted to assess if there were any differences on each of these emotions across conditions at baseline. Overall condition was the independent variable and baseline scores for happiness, amusement, boredom, upset, and confusion served as the dependent variables. There was no multivariate main effect of condition found either across all 8 conditions, Pillai's (15, 771) = 1.03, p = .417, η_p^2 =.02, or across the four overall affective categories, Pillai's (35, 1275) = 1.29, p = .115, η_p^2 = .03, indicating no pre-existing differences in mood at baseline.

For the happiness dimension, the ANOVA revealed a main effect of happiness mood change, $F(1, 132) = 4.90$, p = .029, η_p^2 = .04, but no main effect of condition, $F(3, 132) = 1.16$, p = .329, η_p^2 = .03. There was, however, a significant interaction between changes in feelings of happiness and condition, $F(3, 132) = 2.80$, p = .043, η_p^2 = .06. Overall, feelings of happiness did significantly increase from time one (M = 3.30, SE = .08) to time two (M = 3.42, SE = .09). Examination by condition showed a significant positive change within the positive and humor conditions, but there was no change within the neutral or irony conditions.

For the amused dimension, the ANOVA revealed a main effect of amused mood change, $F(1, 132) = 53.01$, $p < .001$, η_p^2 = .29, but no main effect of condition, $F(3, 132) = 1.94$, p = .126, η_p^2 = .04. There was, however, a significant interaction between changes in feelings of

amusement and condition, $F(3, 132) = 2.06$, $p = .015$, $\eta_p^2 = .08$. Overall, feelings of amusement did significantly increase from time one ($M = 2.64$, $SE = .10$) to time two ($M = 3.31$, $SE = .09$). Examination by condition showed a significant positive change within the positive, humor, and irony conditions, but there was no change within the neutral condition.

For the bored dimension, the ANOVA revealed a main effect of bored mood change, $F(1, 132) = 21.83$, $p < .001$, $\eta_p^2 = .14$, but no main effect of condition, $F(3, 132) = .91$, $p = .439$, $\eta_p^2 = .02$. There was, however, a significant interaction between changes in feelings of boredom and condition, $F(3, 132) = 2.72$, $p = .047$, $\eta_p^2 = .06$. Overall, feelings of boredom did significantly decrease from time one ($M = 2.51$, $SE = .11$) to time two ($M = 2.14$, $SE = .10$). Examination by condition showed a significant negative change within the positive (one-tailed), humor and irony conditions, but there was no change within the neutral condition.

For the confused dimension, the ANOVA revealed neither a main effect of confused mood change, $F(1, 132) = .24$, $p = .625$, $\eta_p^2 = .00$, a main effect of condition, $F(3, 132) = 2.67$, $p = .051$, $\eta_p^2 = .06$, nor an interaction between changes in feelings of confusion and condition, $F(3, 132) = 1.48$, $p = .224$, $\eta_p^2 = .03$.

Finally, for the upset dimension, the ANOVA revealed a main effect of upset mood change, $F(1, 132) = 16.94$, $p < .001$, $\eta_p^2 = .11$, but no main effect of condition, $F(3, 132) = .74$, $p = .538$, $\eta_p^2 = .02$, nor an interaction between changes in feelings of confusion and condition, $F(3, 132) = 1.97$, $p = .122$, $\eta_p^2 = .04$. Examination by condition showed a significant negative change in the positive and neutral conditions, but there was no change within the humor or irony conditions.

Table 29 presents the means for each dimension on the emotion measure both before and after the mood manipulation, separated by all eight conditions.

Memory Test

After completing the creativity tasks, participants were presented with a set of 10 photos and told to select the photos they remember seeing in their respective mood manipulation. There were five previously shown pictures presented in the same pattern for each version of this task.

Participants performed well, with 96% of the sample selecting at least four or more of the correct pictures and 86% selecting only and all of the correct pictures. Four participants selected just two correct photos and eight participants selected just three correct photos. These twelve individuals were removed from the analyses due to their disproportionately poor performance.

Hypotheses

Hypotheses tested in study three included hypothesis 1, 2a, 2b, 3a, 3b, 4a, 4b, 5a, and 5b. Hypothesis 4c was not tested because this study did not administer convergent creativity tasks. A familywise significance level of .05 was used for all analyses.

Hypotheses 1, 2a, 2b, 3a, 3b, 5a, and 5b

The first second, third, and fifth hypotheses were tested by conducting a series of ANOVAs with various divergent outcomes from the unusual uses and product improvement data. As the convergent tasks (i.e., RAT, anagram) were not included in this study only divergent creativity scores were assessed.

The first hypothesis was that participants in the positive affect condition would show improved performance (i.e., higher fluency and novelty scores) on the divergent thinking creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the neutral affect condition, consistent with prior research (Baas et al., 2008).

The second hypothesis was composed of two parts. Hypothesis 2a predicted that participants in the humor condition would show improved performance (i.e., higher fluency and

novelty scores) on the divergent creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the neutral condition. Hypothesis 2b predicted that participants in the humor condition would show improved performance (i.e., higher fluency and novelty scores) on the divergent creativity tasks (i.e., unusual uses and product improvement tasks) compared to those in the positive affect condition.

The third hypothesis was also composed of two parts. Hypothesis 3a predicted that participants in the ironic condition would show improved performance on both the divergent (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks) and convergent (i.e., higher total scores on the Remote Associates Test and anagram tasks) creativity tasks compared to those in the neutral condition. Hypothesis 3b predicted that participants in the ironic condition would show improved performance on both the divergent (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks) and convergent (i.e., higher total scores on the Remote Associates Test and anagram tasks) creativity tasks compared to those in the humor condition. However, this third study did not include the convergent measures. Therefore, the analyses corresponding to these tasks were not conducted.

The fifth hypothesis was also composed of two parts. Hypothesis 5a predicted that participants who were in the positive explain condition would perform better on the divergent creativity tasks (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks) compared to those who were in the positive non-explain condition, as well as both the neutral non-explain and explain conditions. Hypothesis 5b predicted that participants who were in the humor explain condition would perform better on the divergent creativity tasks (i.e., higher fluency and novelty scores on the unusual uses and product improvement tasks)

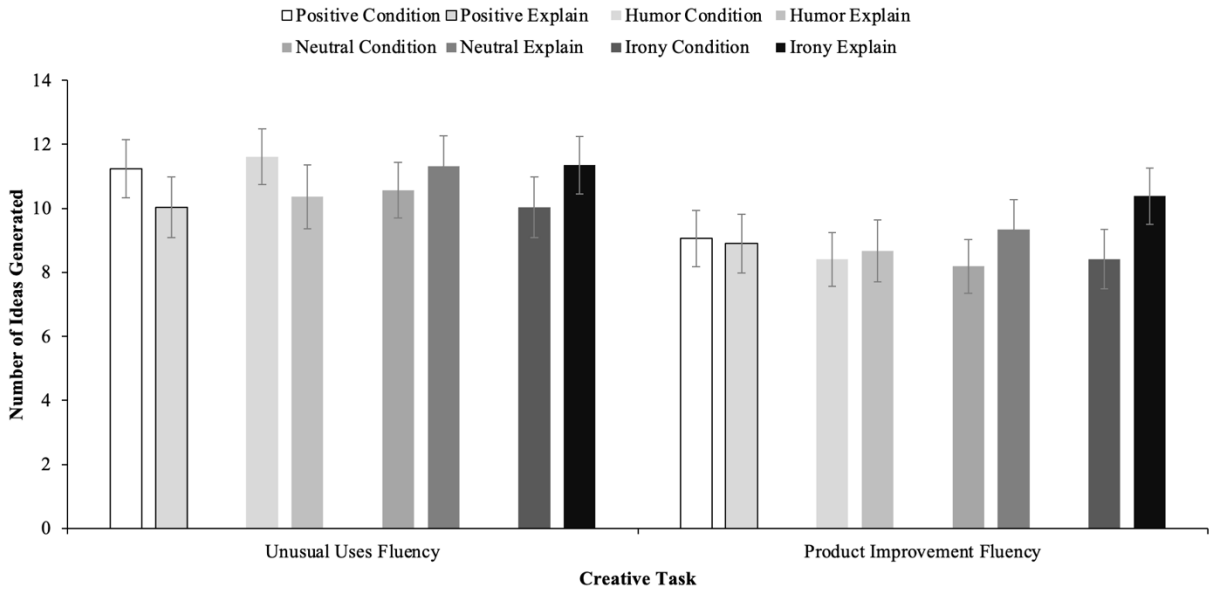
compared to those who were in the humor non-explain condition, as well as both the neutral non-explain and explain conditions.

First, fluency was examined across conditions with a two-way between-subjects MANOVA. Overall affect condition served as one independent variable (i.e., positive, humor, neutral, irony) and whether participants were in an explain condition or not served as the second independent variable. Fluency scores for both the unusual uses task and the product improvement task were entered as dependent variables.

The MANOVA did not show a significant multivariate main effect of overall affect condition, Wilks' (6, 508) = .44, p = .852, η_p^2 = .01, a main effect of explanation, Wilks' (2, 254) = 1.51, p = .223, η_p^2 = .01, nor an interaction between overall affect condition and explanation, Wilks' (6, 508) = .55, p = .770, η_p^2 = .01 (see Figure 5).

Figure 5

Number of Ideas Participants Generated for Divergent Creativity Tasks (Study Three)



Note. Error bars represent standard errors.

Next, novelty was examined across conditions with a two-way between-subjects MANOVA. Overall affect condition served as one independent variable and whether participants were in an explain condition or not served as the second independent variable. Novelty scores for both the unusual uses task and the product improvement task were entered as dependent variables.

The MANOVA did not show a significant multivariate main effect of overall affect condition, Pillai's (6, 510) = .45, p = .858, η_p^2 = .01, a main effect of explanation, Pillai's (2, 254) = .74, p = .480, η_p^2 = .01, nor an interaction between overall affect condition and explanation, Pillai's (6, 510) = .56, p = .760, η_p^2 = .01.

Descriptive statistics for each creativity measure within each overall affect condition are presented in Table 30 while descriptive statistics for each creativity measure within all eight conditions are presented in Table 31.

Finally, to test if the presence of the emotion scale interfered with creativity scores, a series of independent *t*-tests were conducted. The independent variable was whether participants received the post-emotion scale (1) or not (0). The dependent variables were the creativity tests. There were no differences in scores for unusual uses fluency, $t(261) = -1.32$, p = .188, unusual uses novelty, $t(261) = -1.22$, p = .223, product improvement fluency, $t(261) = -1.63$, p = .104, or product improvement novelty, $t(261) = -.23$, p = .822 (See Table 32 for descriptive statistics).

Hypotheses 4a and 4b

Hypothesis four used subscales from the TIPI to score individuals along the personality dimensions of extraversion and openness to experience.

Hypothesis 4a predicted that those who scored higher on openness to experience and who were in the positive and humor conditions were expected to perform better on the divergent creativity tasks.

Hypothesis 4b predicted that those who scored higher on extraversion and who were in the positive and humor conditions were expected to perform better on the divergent creativity tasks.

To test these hypotheses, a series of moderated regressions were conducted in PROCESS with each personality trait as the predictor, each creativity task as the outcome, and mood condition as the moderator. The familywise error rate of .05 was maintained by using a Bonferroni adjusted per-regression significance level of .00625 (i.e., eight separate regressions). Table 33 presents the intercorrelations among the predictors and outcome variables.

To test hypothesis 4a, four separate moderated regressions were conducted with openness as the predictor, condition as the moderator, and the four divergent creativity variables as the outcomes (i.e., unusual uses fluency, product improvement fluency, unusual uses novelty, and product improvement novelty). Openness was centered in each regression. None of the regressions revealed a significant overall model at the adjusted significance level.

To test hypothesis 4b, four separate moderated regressions were conducted with extraversion as the predictor, condition as the moderator, and the five divergent creativity variables as the outcomes. Extraversion was centered in each regression. None of the regressions revealed a significant overall model at the adjusted significance level. See Table 34 for complete regression results. See Table 35 for correlations among mood, personality, and creativity.

Study Three Discussion

The only experimental research (according to present knowledge) similar to the methods implemented in this study are from Rouff (1975). She presented a set of cartoons and asked participants to write explanations of the point (or points) of each cartoon. Responses were scored according to whether participants described the incongruity or main disparity within each cartoon, in addition to describing why that disparity prompted amusement. Results revealed a significant positive correlation (r = .37) between humor comprehension scores and RAT scores. This relationship remained even after controlling for intelligence.

The results of study three indicate that none of the tested hypotheses were supported. However, while not significant, it is interesting that for those in the positive condition, explaining the photos was a detriment to fluency, but for those in the neutral and irony conditions explaining seemed to aid fluency scores. Maybe explaining the photos diminishes the positive mood effect when the outcome is fluency, but potentially helps when the stimuli is more cognitively demanding.

There were instances where individuals were not able to complete their brief explanations before the timer, but most individuals were able to complete their ideas within the allotted time-constraint. In any case, the act of thinking about the underlying elements of the stimuli was the main objective regardless of the completeness of each explanation.

The lack of significant findings in study three is possibly due to inconsistent affective changes for the intended emotions within each condition. It could also be due to the online nature of the study, or that individuals on Prolific complete so many surveys they may be "numb" to emotional stimuli. Mood induction was not stronger for those who were asked to explain their

pictures, even though these participants were given more than double the amount of time to view each picture.

Results from the emotion scale when looking at overall affect conditions indicated feelings of happiness were effectively induced within the positive condition and feelings of amusement were effectively induced within the humor and irony conditions. Change scores were similar between the positive and humor conditions, as were the post-emotion scores for happiness for these two conditions. Unexpectedly, the change score within the irony conditions was the smallest, resulting in no positive affect induction within the irony condition.

Post-emotion scores for amusement were strongest in the irony condition, followed by the humor, positive, and neutral conditions. Change scores were strongest in the humor condition, followed by the irony, positive, and neutral conditions. These results indicate that feelings of amusement were effectively induced within the humor and irony conditions. The post-emotion scores for the irony and positive conditions can be considered close, which does continue to raise questions from study one about the potential confound of feelings of amusement within the positive condition.

Post-emotion scores for boredom were strongest in the neutral condition as predicted, followed by the irony, humor, and positive conditions. Change scores for decreases in boredom were strongest within the irony condition, followed by the humor and positive conditions. There was not a significant change within the neutral condition. These results are consistent with expectations.

Overall, the results from the emotion scale indicated that feelings of happiness were effectively induced within the positive and positive explain conditions, and feelings of amusement were effectively induced within the humor and irony conditions; however, there was

still an increase in feelings of amusement seen for the positive conditions which potentially confounded the results. As expected, feelings of boredom significantly decreased within the positive, humor, and irony conditions, with the neutral condition experiencing the most feelings of boredom. Finally, there were no influences of confusion and upset reported at this point in the survey.

General Discussion

Relative to negative or neutral moods, positive moods (e.g., happiness, amusement) are proposed to increase creativity possibly because they signal a safe environment (De Dreu et al., 2008). This is said to broaden and expand one's field of attention (Friedman & Förster, 2010), increase one's willingness to explore new strategies and modes of thinking (De Dreu et al., 2008; Fiedler, 1988), and enhance propensity for flexible thinking (Isen, 2000), thus allowing one to connect and integrate extensive information. In particular, activating positive moods such as happiness promote creativity the most (Baas et al., 2008). Further, both happiness and amusement are associated with increased dopamine in the brain, which facilitates switching among cognitive sets (Ashby et al., 1999; Boot et al., 2017; Chermahini & Hommel, 2010).

Three studies were conducted with the chief intention of replicating past research finding positive mood can enhance creative performance relative to a mood-neutral control (Baas et al., 2008; Lyubomirsky et al., 2005). These prior studies primarily used humor to induce a positive mood, however humor is only one representation along a spectrum of positive emotionality. Differences were anticipated on various measures of creative performance between those who reported feeling higher levels of general happiness and those who experienced amusement specifically. Humor shares many similar underlying elements with creativity along with being

categorized as a positive, activating emotion (Baas et al., 2008). Therefore, it was predicted that creativity scores would be superior for those who were amused.

Contrary to expectations, the results from these three studies did not support this idea; however, study one and study two did replicate the positive mood effect found in past research. Participants in the positive condition listed more ideas for the Unusual Uses and Product Improvement tasks compared to those in the neutral condition (study one) or irony condition (study two). Study two additionally found those in the positive condition listed ideas for the Unusual Uses test that were more novel than participants who were in the irony condition. No differences were found among conditions for either convergent measure in study two or either divergent measure in study three. There were no differences on any creative measure in any study which found those in the humor or irony condition to list a greater number or more original ideas relative to the positive or neutral condition. However, a meta-analysis using the four independent comparisons of the positive to neutral conditions on fluency scores from the unusual uses test does directionally support prior research with positive mood and creativity (g = .23, 95% CI [-.27, .72]). In addition, a meta-analytic summary of the partial correlations (controlling for happiness) between post-manipulation self-reports of amused emotion and creativity showed small, non-significant effects for fluency ($r_{paperclip}$ = .07, 95% CI [-.12, .26]; $r_{elephant}$ = .11, 95% CI [-.17, .38]), but larger, significant effects for novelty ($r_{paperclip}$ = .09, 95% CI [.05, .14]; $r_{elephant}$ = .19, 95% CI [.14, .25]).

Likewise, the only regression concerning personality, condition, and creativity out of all three studies to reveal significant results was from study one. Individuals who were more extraverted and who were in the positive condition listed more ideas for the Unusual Uses task. None of the other regressions with any of the other divergent or convergent dependent variables

were significant. This is surprising as openness has a well-reported relationship with creativity (Chamorro-Premuzic & Reichenbacher, 2008; Kaufman, 2016; McCrae, 1987; Williams, 2004).

While not a direct hypothesis of this study, data from the humor styles questionnaire were used in a cluster analysis for all three studies with the purpose of replicating the clusters found in Galloway (2010). Specifically, the general humor endorser cluster where individuals use all four humor styles (i.e., affiliative, aggressive, self-enhancing, self-defeating) at an above-average level. Only study two and three revealed this cluster. With the purpose of extending the previously mentioned findings of Chang and colleagues (2015) to a verbal creative task, it was found that general humor endorsers did tend to perform better on the divergent creativity tasks relative to those in the other clusters (i.e., those low on all styles, those high on positive styles and low on negative styles, and those low on positive styles and high on negative styles); however, only study two found significant effects. General humor endorsers listed more ideas for the unusual uses fluency task, $F(2, 176) = 3.82$, $p = .024$, $\eta_p^2 = .04$, and listed more novel ideas for the product improvement task, $F(2, 176) = 7.42$, $p = .001$, $\eta_p^2 = .08$, relative to the other clusters. While these results did not cleanly replicate and extend that of Galloway (2010) and Chang and colleagues (2015), it does show some trending support for the idea that holding opposing elements is beneficial to creativity (Barron & Harrington, 1981; Csikszentmihalyi, 1996; Huang, 2020).

Positive activated emotions such as happiness (and amusement) tend to degrade when participants spend more than a few minutes on a task (Baas et al., 2008), implying the effects of the mood inductions may have expired while participants were working on the creativity tasks, neutralizing scores. Unfortunately, ancillary analyses examining whether performance was better in the hypothesized conditions for the first task presented still failed to reveal significant effects.

The absence of support for the hypotheses may be attributed to a myriad of explanations not limited to low power (i.e., study one and two), the online nature of the study, or conflated affective responses among the conditions. Additionally, the data were collected during the unprecedented times of the COVID-19 pandemic. It is unclear if these data can be generalized to other less eventful periods of time.

Baas and colleagues (2008) argue that positive moods enhance creativity when the task is presented as enjoyable and intrinsically rewarding, but performance will suffer if the task is framed as serious and extrinsically rewarding. The extrinsic motivation of monetary payment or partial course credit as well as formal tone of the study may have undermined creative performance; however, they also state "to make a difference in creative performance, manipulating mood states is not very effective and is unlikely to produce clear and visible changes in creativity" (Baas et al., 2008, p. 796). In fact, while mood is a common predictor of creativity in the literature, the findings from these studies show inconsistent patterns (Baas, 2019; Baas et al., 2008; Davis, 2009). It seems that this study is not the first to find muddled results when attempting to manipulate mood states.

Another explanation originates from the creativity tasks being timed. Runco and Acar (2019) stress that divergent tasks should not have a time limit. They argue time constraints imply the presence of an evaluation, and evaluations relate to extrinsic expectations which again undermine creative performance.

Limitations

While this study implemented methodology based on past research within the humor and creativity literature, it is not without several weaknesses. First, the online nature of this study could produce a controlled environment such as in the laboratory. Participants may have been

distracted, not completing the study with focused intention, thereby compromising creativity scores.

Placing the emotion measure immediately after the affect induction was intended to capture participants immediate feelings after viewing the stimuli. There is a potential issue of demand characteristics where participants could have reported that their mood changed in ways it actually did not. In that case, they could have, for example, reported their mood was happier because they believed the researcher wanted them to be, but in fact they were not. This may be an additional explanation for the null findings.

The use of memes in each of the experimental conditions was intended to provide a standardized format of stimuli, but it may have unexpectedly conflated the conditions. One function of a meme is to induce laughter in the recipient (Densiova, 2019) and participants may have categorized the stimuli within each condition as a meme and thought its intention was to induce that laughter. When capable, examination of mood states within each affect condition consistently showed the positive condition to increase their feelings of amusement after viewing their respective stimuli, even though it was not intended to evoke a humorous response. Another potential explanation for this result is that participants may have conceptualized amusement to be similar or the same as happiness. That is, to participants, maybe amused is a synonym for happiness.

It is also possible this study was limited to the strength of the affect induction. That is, photos in the positive condition were rated as very strongly positive, but photos in the humor condition were only rated moderately strong for amusement. This difference in stimuli ratings may have influenced the pattern of results seen in these studies. It is thus unclear if humor may

have a bigger influence on creativity if there is a stronger induction of amusement for the presented stimuli.

Only fluency and novelty were scored for the divergent measures; flexibility or elaboration were not. Prior studies measuring both humor and creativity used fluency as the predominant outcome, followed by originality; flexibility and elaboration were only used sparingly. In the interest of replicating past relationships between creativity and humor, only the two most common aspects of divergent creativity were used. Unfortunately, that neglects possible effects with the other aspects.

Divergent thinking is not the same as creative thinking (Runco & Acar, 2012). Many researchers use DT tasks to measure “general" creative output, but one’s ability to excel at a DT task does not necessarily mean that person is creative in all aspects of the construct. DT is only one aspect of creativity and does not reflect one’s full creative potential. DT tasks additionally vary greatly in structure (e.g., verbal, figural), time allotment (e.g., five-minutes, 10-minutes), scoring (e.g., fluency, originality), and method (e.g., top three, frequency-based) which makes it difficult to draw confident conclusions even within this category of tasks itself. As such, the findings of this study can only be generalized for the specific types of divergent tasks used here, and do not necessarily equate to true creative ability. Likewise, just because a participant lists many ideas (i.e., obtaining a high fluency score), it does not necessarily signify that they were thinking divergently.

The Remote Associates Test (Mednick, 1962) was a commonly used task in the humor-creativity literature and positive relationships were found between the constructs (Brodzinsky & Rubien, 1976; Feingold & Mazzella, 1991; Huang et al., 2015; Treadwell, 1970). Unfortunately, contemporary researchers struggle to consistently categorize the task as divergent or convergent

(Lee et al., 2014). This measure may also be dated as a creativity task because it is said to rely heavily on one's culture, intelligence, and prior knowledge (Kaufman, 2016; Kaufman & Glăveanu, 2019).

Due to the online nature of this study, participants could have used an internet search engine to retrieve answers for the Remote Associates Test as well as the anagram task making scores for these tasks inaccurate. Other studies using these tasks found comparable means for a similar period of time (Gilam et al., 2018; Gilhooly & Murphy, 2005; Huang et al., 2015), but it cannot be determined if participants solved these problems on their own.

The personality measure used was chosen because it was short and would not take up much time; however, personality is complex. When one is investigating the boundaries by which creativity and humor interact with various personality traits more specificity is needed than what the TIPI can provide. For example, extraversion is said to be related to creativity, but not in the way of sociability. Creative people actually tend to be more introverted, autonomous, and socially withdrawn (Feist, 1998; 1999; 2019). Additionally, they tend to be independent, confident, assertive, and often reject norms, traditions, and conservative ideologies (Feist, 1998; 2019). Furthermore, two major components of openness to experience include openness and intellect which describe different sets of creative individuals. Individuals higher in openness tend to be more artistically creative, whereas individuals higher in intellect tend to be more scientifically creative (Feist, 2019; Kaufman et al., 2016).

This dissertation did not provide a measure of intelligence, yet there are numerous mentions of its influence within the literature for both humor and creativity (Kaufman et al., 2008; Martin, 1998; Sternberg & Lubart, 1991). Research on intelligence as measured in terms of achievement and aptitude (i.e., crystallized intelligence) tends to find only a small positive

correlation (r = 0.17; Byrne, 1956; Feingold, 1983; Horn & Cattell, 1966; 1967; Kane et al., 2004; Kim, 2005; Silvia, 2008); however, fluid intelligence (i.e., the ability to solve novel problems) consistently reveals positive correlations with divergent thinking scores (Benedek et al, 2012; Horn & Cattell, 1966; 1967; Jauk et al., 2013; Nusbaum & Silvia, 2011; Vartanian, 2019), and may even contribute to humor comprehension (Feingold & Mazella, 1991, 1993; Wierzbicki & Young, 1978; Ziv & Gadish, 1990).

Participants chose to complete one of these studies most likely because they were either going to be receiving payment or partial course credit. Either way, the motivation to complete this study was extrinsic (i.e., for an external incentive outside of the task itself). Intrinsic motivation (i.e., approaching a task out of pure interest) is necessary for creativity, while extrinsic motivation is most likely detrimental (Amabile, 1988). In particular, participants who completed this study received task-contingent rewards. Research finds these types of rewards to continually impair intrinsic task interest and subsequently creative performance (Hennessey, 2019; Lepper et al., 1973).

Future Research

Generation-focused DT tasks such as those used in this paper are shown to have predictive validity for creative hobbies and accomplishments later in life (Priester & Fleming, 2020; Runco, 1988; Runco et al., 2000), but problem-focused divergent thinking tasks show evidence for greater predictability of creativity-related measures (Kaufman et al., 2008). As mentioned above, DT does not necessarily equate to domain-general creative ability. According to Plucker and Renzulli (1999), the creative process begins with problem identification and ends with solution evaluation (with DT in the middle). Future studies are advised to explore humor's influence at each phase of this process.

Using static images for an online study may not be as effective for inducing emotional affects as audiovisual material presented during an in-lab visit. Due to the online nature of this study, it is unclear if participants attention was diverted while viewing the photos in their conditions. Therefore, affect induction may be better induced during in-person lab appointments where there is less potential for distraction. Additionally, audiovisual stimuli such as film-clips may be better for inducing the emotional affects intended in this paper. Ellard and colleagues (2012) suggest that when investigating emotional processing as an outcome, music or films may be more effective than static images. Future studies are encouraged to test whether there is a disadvantage to static stimuli presented online compared to audiovisual material presented in-person.

Because positive mood was the focus of this dissertation, the images shown in the experimental conditions were selected to increase the target emotions respective to each condition while simultaneously minimizing any potential negative moods. However, negative mood may be an important contributor to creative performance. While happiness is the most robust predictor relative to other mood states, its relationship to creativity is still quite small (Baas, 2019; Baas et al., 2008). In fact, Baas (2019) advises a focus instead on activating mood states with either an approach (e.g., happiness, anger) or avoidance (e.g., fear, anxiety) orientation. Negative, activating moods such as anger, anxiety, and fear have been shown to also promote creativity (Akinola & Mendes, 2008; Baas et al., 2008; De Dreu et al., 2008; To et al., 2012). Specifically, negative moods are thought to improve creativity through increased cognitive persistence (De Dreu et al., 2008), possibly because they signal an unsatisfactory state that facilitates goal-oriented processing (Ambady & Gray, 2002). Whereas positive moods act to increase cognitive flexibility, negative moods act primarily through cognitive persistence (De

Dreu et al., 2008). This ability to maintain focused attention may be particularly beneficial for certain creative tasks over others. Instead of using ironic photos to control for negative emotionality, maybe the underlying aggressive nature of sarcasm is important. Future researchers are advised to compare various aspects of negative forms of humor, such as sarcasm or parody in addition to focusing on activating positive emotionality in particular.

Cognitive research differentiates attention by either being flexible (i.e., allowing one to adjust their focus) or leaky (i.e., allowing extraneous information into one's awareness). Some studies found participants with higher divergent thinking scores display more flexible attention, whereas participants with higher "real-world" creativity (Creative Achievement Questionnaire; CAQ; Carson et al., 2005) display more leaky attention (Vartanian, 2019; Zabelina et al., 2015). Zabelina and colleges (2015) conclude that "leaky sensory gating may help people integrate ideas that are outside of focus of attention, leading to creativity in the real world; whereas divergent thinking, measured by divergent thinking tests which emphasize numerous responses within a limited time, may require selective sensory processing more than previously thought" (p. 77). This may explain how positive mood through humor can help divergent thinking scores. It would be interesting to test if leaky attention can be ignited with humor and/or is helpful for humor production.

It would be interesting to test whether humor can facilitate group brainstorming by creating a more comfortable creative climate. When humor is expressed in teams it predicts better performance and more functional communication (Aaker & Bagdonas, 2021; Lehmann-Willenbrock & Allen, 2014). Research on climate suggests that the three primary factors that contribute to a successful one is the task itself, interpersonal cohesiveness, and dynamic-energetic components (Karwowski, 2011; Karwowski & Lebuda, 2013). We already know

humor can facilitate bonding and help diffuse conflict (Morreall, 2016), so the logic would follow that its employment could further aid in balancing stability and flexibility, while also increasing risk-taking behind the guise of humor (Kaufman & Glăveanu, 2019). Groups who are in positive moods tend to be more creative than those in neutral or negative moods (Shin, 2014). Coupling this with humor's social facilitative abilities may enhance creative ideation.

Humor is inherently social and may be better utilized in a more naturalistic and spontaneous manner to maintain a positive, activated state. For example, Pollio and Bainum (1983) found groups which produced more laughter solved more anagrams. Likewise, Firestien and McCowan (1988) found groups which demonstrated more verbal and nonverbal indications of amusement generated more ideas to a divergent prompt. Expanding on these studies, it would be interesting to investigate if one's involvement in producing humor positively relates to group creative performance.

Differentiating humor production, appreciation, and comprehension in the same participants would also be of benefit. Few researchers have clearly indicated which form of humor they are measuring in their studies, and even less have identified and compared each to one another. Since the majority of research concerns humor appreciation, but humor production is likely to have a stronger correlation with creativity (Ruch & Heintz, 2018), it would be interesting to see how the effect sizes of each differ among the various humor areas. Humor production weakly but positively correlates with appreciation, and comprehension positively correlates with both production and appreciation (Kaufman et al., 2008; Kozbelt & Nishioka, 2010; Roeckelein, 2002; Wierzbicki & Young, 1978), but when developing the MSHS, Thornson and Powell (1993) found that humor production and appreciation loaded onto different factors. Thus, it may be that humor ability is domain-specific. It would be interesting to see a formal

comparison of these various forms of humor against various forms of creativity, both between and within persons.

The statement "a creative product is not always (or even usually) funny, and a funny idea is creative only in a very special way, involving originality and a resolution that takes social, human factors into account" (O'Quin & Derks, 1997, p. 245) could also be explored. It may be that humor is its own form of creativity, and that this unique ability for a person to produce humor is only correlated with certain forms of creativity because it is itself a form of creativity. Professional comedians, much like artists or scientists, build up a library of knowledge, experience, and resources for their craft (Siegler, 2004). Just as creativity in one domain (e.g., drawing) does not necessitate creativity in another (e.g., music); it may be that humor is its own creative domain which may not transfer well to many generic laboratory tasks, and researchers may see stronger effects when the task is humor-specific. It would benefit the field for future research to provide a formal comparison and potentially explore this domain-specific hypothesis.

Conclusion

A humorous bio on a résumé can make an applicant appear more intelligent, likeable, and desirable as a colleague (Aaker & Bagdonas, 2021) – but one does not have to be funny to reap the benefits of humor in the workplace. Managers with a sense of humor (but who are not necessarily funny) are rated as friendlier and are more respected by their employees (Decker et al., 1987). Further, 84 percent of employees believe a sense of humor allows them to do better work (Aaker & Bagdonas, 2021). Humor sprinkled into a presentation can raise the perceived competency, confidence, and status of the presenter (Bitterly et al., 2017). In negotiation, humor can reduce tension between buyer and seller; a small joke attached to an offer can persuade the buyer to not only pay more on average for the product or service, but also make the buyer feel

better about the negotiation itself and their relationship with the seller (Kurtzberg et al., 2009; O'Quin & Aronoff, 1981).

Humor can induce a safe environment, facilitate feelings of trust, diffuse tension, encourage risk-taking, form personal connections, and incite a positive mood. Adding a small amount of levity to a challenging problem may allow that problem to be understood by more people who otherwise would not willingly put the time or energy into understanding it (Aaker & Bagdonas, 2021).

Creativity forms the foundation of both personal and professional success (Glăveneanu & Kaufman, 2019) but creativity can require a lot of trial and error. When a creative idea doesn't become implemented or a solution doesn't work, feelings of failure can become strong. Humor can help us manage those emotions, transforming those failures into forward momentum. According to former head of Apple's Creative Design Studio, Hiroki Asai, "Fear is the greatest killer of creativity and humor is the most effective tool I've found for insulating cultures from fear" (Aaker & Bagdonas, 2021, p. 55-56). Humor and levity can free people from fear and mental restraint. Leaders who are afraid to fail may be stifling their creative potential, and the employees of these leaders are suffering as well. Failing is learning, and with learning and knowledge comes practice, new insights, and creativity. Humor can help open ourselves up to the possibility of failure, making it not seem as bad. It can induce a safe environment to discuss those failures in a lighter way, inviting others to feel safe about failing themselves, and potentially aiding creativity.

Humor can make a leader more approachable, and an approachable manager can increase employee engagement by at least 30 percent (Harter & Adkins, 2015). Further, leaders who use humor are rated as more trustworthy and attentive by their employees (Hoption et al., 2013). At a

time when people trust a complete stranger more than their boss and “time is money”, humor’s ability to accelerate feelings of joy, trust, and respect provides a clear advantage (Aaker & Bagdonas, 2021; Sturt & Nordstrum, 2018).

While these studies did not find that humor in particular can facilitate creative performance (although the meta-analytic summary found some support), they did find a positive mood to help. The findings of these studies were not compelling, but with a better set of stimuli, possibly different tasks, or even switching to a humor production perspective, more convincing results are possible. Numerous citations on this topic imply this relationship exists, so while these findings do not support what was expected, the potential remains.

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Table 1

Overall Mean Ratings from Meme Selection Survey I

	Positive Condition		Humor Condition		Neutral Condition	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Positivity	6.56	.78	5.00	1.42	4.05	.63
Humorousness	3.93	1.25	5.45	1.43	4.05	.90
Offensiveness	1.31	1.25	1.70	1.78	2.16	1.27

Table 2

Demographic Information for Participants (Pilot Study)

Variable Name	*N*	*%*	*M*	*SD*	*Min*	*Max*
Conditions						
Positive	29	33.7%				
Humor	32	37.2%				
Neutral	25	29.1%				
Gender						
Male	13	15.1%				
Female	73	84.9%				
Age	86		18.95	1.97	18	30
Race						
African-American/Black	11	12.8%				
East Asian/South Asian/Pacific Islander	17	19.8%				
Caucasian/White	19	22.1%				
Hispanic/Latino	34	39.5%				
Middle Eastern/North African/Arab American	2	2.3%				
Choose not to answer	3	3.5%				
English as a first language						
Yes	59	68.6%				
No	27	31.4%				

Table 3

Descriptive Statistics from Emotion Scale (Pilot Study)

	Positive Condition			Humor Condition			Neutral Condition		
	Post-Measure	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*
Happiness	4.31 (.79)	3.63 (1.09)	.69*	4.19 (.98)	3.63 (1.31)	.56*	3.64 (.93)	3.57 (.85)	.07
Amused	3.50 (1.21)	2.81 (1.11)	.69*	4.00 (1.16)	3.06 (1.06)	.94*	3.71 (.73)	2.93 (.83)	.79*
Bored	2.25 (1.44)	3.19 (1.42)	-.94*	2.38 (1.54)	3.56 (1.09)	-1.19*	2.29 (1.14)	2.71 (1.27)	-.43
Upset	1.19 (.54)	1.44 (.81)	-.25	1.63 (.96)	1.88 (.89)	-.25	1.57 (.65)	1.86 (.66)	-.29
Confused	1.38 (1.09)	1.63 (1.15)	-.25	2.06 (1.57)	2.25 (1.29)	-.19	2.07 (1.14)	1.50 (.76)	.57

Note. Standard deviations in parentheses; $N_{\text{Positive}} = 16$, $N_{\text{Humor}} = 16$, $N_{\text{Neutral}} = 14$; *denotes significance at $p < .05$ (two-tailed).

Table 4

Overall Mean Ratings from Meme Selection Survey II

	Positive Condition		Humor Condition		Neutral Condition		Irony Condition	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Positivity	6.23	1.18	4.74	1.22	4.07	1.02	3.56	1.38
Humorousness	3.45	1.86	4.77	1.58	3.63	1.74	4.26	1.82
Boring	3.86	.79	3.91	1.06	3.11	1.47	3.54	1.64
Sarcasm/Irony	1.55	.96	2.61	1.70	2.64	1.71	4.27	2.08
Offensive	1.37	1.44	1.64	1.54	2.06	1.55	2.54	1.35

Table 5

Means and Standard Deviations for Each Picture in Each Condition

			Rating Dimension				
Positive Condition							
	Order	Picture Name	Positive	Humor	Boring	Ironic	Offensive
	1	Pokemon Happy	6.55 (.69)	3.00 (1.94)	3.42 (1.51)	1.00 (0)	1.00 (0)
	2	Happy Puppy	6.63 (.74)	4.29 (1.60)	4.43 (1.40)	1.00 (0)	1.00 (0)
	3	Love	5.79 (1.12)	4.00 (1.91)	4.31 (.86)	2.30 (1.49)	1.64 (1.21)
	4	News	6.00 (1.81)	2.90 (2.47)	3.08 (1.68)	1.00 (0)	1.00 (0)
	5	Bob Ross	6.31 (.86)	1.73 (1.68)	4.54 (1.94)	1.50 (1.07)	1.00 (0)
	6	Pikachu	6.20 (1.87)	3.20 (2.10)	2.91 (1.38)	1.00 (0)	1.00 (0)
	7	Friends	6.14 (1.22)	4.29 (1.50)	3.43 (1.51)	2.00 (1.73)	2.67 (2.89)
	8	Life	6.33 (.89)	2.56 (1.71)	3.75 (1.60)	1.43 (1.13)	1.38 (1.06)
	9	Dog Parade	6.40 (1.27)	5.70 (1.57)	4.90 (1.52)	2.29 (2.36)	1.43 (1.13)
	10	Toy Story	5.93 (1.34)	2.83 (1.99)	3.86 (1.03)	2.00 (1.81)	1.60 (1.58)
Humor Condition							
	Order	Picture Name	Positive	Humor	Boring	Ironic	Offensive
	1	Making Out	4.60 (.91)	5.53 (1.25)	4.21 (1.37)	3.33 (1.61)	1.67 (1.32)
	2	Brenda	4.09 (.83)	4.73 (1.79)	3.67 (1.23)	2.00 (1.16)	1.38 (1.06)
	3	Bee Haw	4.86 (1.57)	4.29 (.76)	4.00 (1.29)	3.25 (1.50)	2.20 (1.64)
	4	Woofles	5.30 (1.34)	5.18 (2.09)	4.60 (2.21)	2.89 (2.42)	1.33 (.82)
	5	Twelve	4.00 (.73)	4.94 (1.56)	3.82 (1.07)	2.57 (1.45)	2.31 (1.84)
	6	Harold	2.94 (1.61)	3.13 (1.93)	2.75 (1.18)	3.07 (2.12)	2.14 (1.23)
	7	Formal	6.23 (1.30)	4.85 (1.46)	4.92 (1.38)	2.25 (1.83)	1.50 (1.07)
	8	Good Boy	5.91 (1.22)	5.00 (2.32)	4.09 (2.26)	1.44 (.73)	1.25 (.71)
	9	Dad Book	4.75 (1.17)	5.00 (1.20)	3.14 (1.95)	3.14 (2.55)	1.00 (0)
	10	Parents	4.73 (1.49)	5.00 (1.41)	3.90 (1.45)	2.14 (1.68)	1.62 (.92)
Neutral Condition (I)							
	Order	Picture Name	Positive	Humor	Boring	Ironic	Offensive
	1	Insurance	3.55 (1.19)	2.23 (1.54)			2.23 (1.54)
	2	Baby on Board	4.06 (1.52)	4.37 (2.03)			2.82 (1.54)
	3	Clever	3.95 (1.76)	4.29 (1.85)			3.79 (2.08)
	4	Wikipedia	3.94 (1.00)	4.86 (1.80)			2.20 (1.40)
	5	Can do Bunny	5.60 (1.60)	4.11 (1.73)			1.50 (1.07)
	6	Mosquito	4.25 (1.29)	4.25 (1.65)			2.38 (1.51)
	7	Shark Skiing	4.12 (.70)	4.40 (1.79)			1.44 (1.01)
	8	Shoes	3.73 (.88)	3.57 (2.09)			1.40 (.70)
	9	Migraines	3.58 (1.39)	4.18 (1.74)			2.45 (1.19)
	10	Chameleon	3.76 (1.20)	4.21 (1.58)			1.43 (.79)
Neutral Condition (II)							
	Order	Picture Name	Positive	Humor	Boring	Ironic	Offensive
	1	Tonight	3.09 (1.14)	2.45 (2.16)	2.08 (1.31)	3.00 (2.19)	2.60 (2.12)
	2	Java	3.43 (1.40)	2.60 (1.51)	2.56 (1.67)	2.89 (1.83)	2.00 (1.58)
	3	Work	6.10 (1.20)	4.00 (2.31)	2.91 (1.97)	1.57 (1.13)	1.71 (1.25)
	4	Another	4.20 (1.03)	4.56 (1.81)	3.89 (1.17)	2.63 (1.77)	2.50 (1.64)
	5	Hazmat	3.27 (1.22)	3.20 (2.08)	2.87 (1.69)	3.00 (2.15)	2.00 (1.48)
	6	Catalysis	4.00 (.41)	3.70 (1.16)	3.09 (1.38)	3.00 (1.41)	2.00 (1.32)
	7	Capacitor	4.30 (.95)	4.11 (1.05)	3.44 (1.88)	2.30 (1.57)	1.43 (1.13)
	8	Dilute	3.89 (.93)	4.00 (2.14)	3.86 (1.57)	3.00 (2.07)	2.00 (1.29)
	9	Fascinated	4.75 (1.22)	4.08 (2.14)	3.33 (1.72)	1.91 (1.38)	1.55 (1.21)
	10	Quantum	3.70 (.68)	3.56 (1.24)	3.11 (1.17)	3.13 (1.64)	2.80 (1.64)
Irony Condition							
	Order	Picture Name	Positive	Humor	Boring	Ironic	Offensive
	1	March	2.93 (1.64)	4.00 (2.00)	3.29 (1.72)	5.53 (2.38)	3.00 (2.08)
	2	Cognition	3.71 (1.38)	4.60 (1.72)	4.20 (1.47)	5.14 (1.92)	3.09 (1.92)
	3	Texts	2.38 (1.71)	2.82 (1.98)	3.13 (1.46)	4.25 (1.84)	2.71 (1.82)
	4	Lit	3.50 (1.62)	3.92 (2.28)	3.67 (1.50)	4.42 (1.98)	2.56 (1.51)
	5	Grocery	3.13 (1.13)	5.25 (2.05)	3.75 (.89)	4.63 (1.77)	1.86 (1.07)
	6	Majority	3.88 (1.13)	5.25 (1.04)	3.50 (1.20)	3.00 (2.00)	2.50 (1.98)
	7	Minnie	4.80 (1.30)	4.83 (.75)	3.80 (1.10)	4.25 (2.50)	3.33 (2.08)
	8	Views	3.37 (1.77)	3.00 (2.56)	2.89 (1.69)	3.00 (2.20)	1.50 (1.23)
	9	Unpossible	4.10 (1.45)	4.50 (2.07)	3.60 (1.78)	3.90 (2.08)	2.38 (1.51)
	10	Communication	3.80 (.63)	4.40 (1.78)	3.60 (.70)	4.56 (2.13)	2.50 (1.27)

Note. Standard deviations in parentheses; Survey for Neutral Condition (II) did not include boring and ironic rating dimensions.

Table 6

Demographic Information for Participants (SONA Sample; Study One)

Variable Name	*N*	%	*M*	*SD*	*Min*	*Max*
Conditions						
Positive	19	30.6%				
Humor	23	37.1%				
Neutral	20	32.3%				
Gender						
Male	14	22.6%				
Female	48	77.4%				
Age	62		21.10	4.45	17	45
Race						
African-American/Black	5	8.1%				
East Asian/South Asian/Pacific Islander	17	27.4%				
Caucasian/White	13	21.0%				
Hispanic/Latino	24	38.7%				
Middle Eastern/North African/Arab American	1	1.6%				
Choose not to answer	2	3.2%				
English as a first language						
Yes	42	67.7%				
No	20	32.3%				

Table 7

Demographic Information for Participants (mTurk Sample; Study One)

Variable Name	*N*	*%*	*M*	*SD*	*Min*	*Max*
Conditions						
Positive	10	37.0%				
Humor	5	18.5%				
Neutral	12	44.4%				
Gender						
Male	7	25.9%				
Female	20	74.1%				
Age	27		45.52	12.67	22	77
Race						
African-American/Black	2	7.4%				
East Asian/South Asian/Pacific Islander	2	7.4%				
Caucasian/White	23	85.2%				
Hispanic/Latino	0	0.0%				
Middle Eastern/North African/Arab American	0	0.0%				
Choose not to answer	0	0.0%				
English as a first language						
Yes	27	100.0%				
No	0	0.0%				

Table 8

Demographic Information for Participants (Combined Sample; Study One)

Variable Name	*N*	*%*	*M*	*SD*	*Min*	*Max*
Conditions						
Positive	29	32.6%				
Humor	28	31.5%				
Neutral	32	36.0%				
Gender						
Male	21	23.6%				
Female	68	76.4%				
Age	89		28.51	13.74	17	77
Race						
African-American/Black	7	7.9%				
East Asian/South Asian/Pacific Islander	19	21.3%				
Caucasian/White	36	40.4%				
Hispanic/Latino	24	27.0%				
Middle Eastern/North African/Arab American	1	1.1%				
Choose not to answer	2	2.2%				
English as a first language						
Yes	69	77.5%				
No	20	22.5%				

Table 9

Intercorrelations of Creativity Variables (Study One)

Variable Name	1	2	3	4	5	6
1. Unusual Uses Fluency	1					
2. Unusual Uses Novelty	.519**	1				
3. Product Improvement Fluency	.657**	.327**	1			
4. Product Improvement Novelty	.044	.054	-.007	1		
5. Remote Associates Test	.187	.236*	.166	.119	1	
6. Anagrams	.054	.061	-.029	.107	.344**	1

Note. *denotes significance at $p < .05$ (two-tailed); ** denotes significance at $p < .01$ (two-tailed).

Table 10

Descriptive Statistics from Emotion Scale (Study One)

	Positive Condition			Humor Condition			Neutral Condition		
	Post-Measure	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*
Happiness	4.20 (1.10)	3.60 (1.18)	.60*	3.75 (1.24)	3.38 (.96)	.37*	3.94 (1.06)	4.22 (.81)	-.28
Amused	4.13 (.83)	3.07 (1.22)	1.06*	3.94 (1.12)	3.13 (.96)	.81*	3.67 (1.19)	3.11 (1.23)	.56*
Bored	1.87 (.99)	2.53 (1.41)	-.66*	2.00 (1.10)	2.63 (1.15)	-.63*	2.39 (1.20)	2.78 (1.17)	-.39
Upset	1.20 (.56)	1.53 (.74)	-.33	1.50 (1.10)	1.81 (1.28)	-.31	1.78 (1.26)	1.72 (1.23)	.06
Confused	1.20 (.56)	1.07 (.26)	.13	1.19 (.54)	1.44 (.81)	-.25	1.78 (1.11)	1.67 (1.28)	.11

Note. Standard deviations in parentheses; $N_{positive} = 15$, $N_{humor} = 16$, $N_{neutral} = 18$; *denotes significance at $p < .05$ (two-tailed).

Table 11

Descriptive Statistics for Each Creativity Measure (Study One)

Variable Name	Positive Condition	*SD*	Humor Condition	*SD*	Neutral Condition	*SD*
Unusual Uses Fluency	9.93	6.40	8.21	3.20	6.75	3.07
Product Improvement Fluency	8.41	7.16	6.29	4.29	4.28	2.58
Unusual Uses Novelty	2.29	.37	2.19	.38	2.09	.38
Product Improvement Novelty	2.31	.53	2.51	.70	2.35	.74
Remote Associates Test	5.25	3.49	6.38	3.76	6.63	3.85
Anagrams	6.39	4.05	5.31	3.71	5.60	3.21

Note. $N_{positive} = 29$, $N_{humor} = 28$, $N_{neutral} = 32$ (divergent); $N_{positive} = 28$, $N_{humor} = 26$, $N_{neutral} = 30$ (convergent).

Table 12

Descriptive Statistics for Each Creativity Measure, Separated by Presence of Post-Emotion Measure (Study One)

	Post-Emotion Scale Absent			Post-Emotion Scale Present		
Variable Name	*Mean*	*SD*	*N*	*Mean*	*SD*	*N*
Unusual Uses Fluency	9.13	5.22	40	7.53	3.96	49
Product Improvement Fluency	7.78	6.77	40	5.02	3.04	49
Unusual Uses Novelty	2.25	.36	40	2.14	.40	49
Product Improvement Novelty	2.31	.61	40	2.44	.71	49
Remote Associates Test	5.26	3.31	39	5.98	3.83	49
Anagrams	5.11	3.86	38	6.79	3.49	47

Table 13

Intercorrelations of Predictors and Outcome Variables (Study One)

Variable Name	1	2	3	4	5	6
1. Openness	1					
2. Extraversion	.097	1				
3. Unusual Uses Fluency	.101	.012	1			
4. Unusual Uses Novelty	.089	-.131	.519*	1		
5. Product Improvement Fluency	.170	.055	.657*	.327*	1	
6. Product Improvement Novelty	.019	.074	.044	.054	-.007	1

Note. *denotes significance at $p < .01$ (two-tailed).

Table 14

Descriptive Statistics for Personality Predictors and Creativity Outcome Variables (Study One)

Personality Characteristic	Condition	*N*	Unusual Uses Fluency		Product Improvement Fluency		Unusual Uses Novelty		Product Improvement Novelty	
			M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Openness to Experience										
	Positive Condition	29	9.93	6.40	8.41	7.16	2.29	.37	2.30	.53
	Humor Condition	28	8.21	3.20	6.29	4.29	2.19	.38	2.51	.70
	Neutral Condition	30	6.80	3.16	4.30	2.61	2.07	.38	2.36	.77
Extraversion										
	Positive Condition	27	10.00	6.55	8.56	7.30	2.31	.38	2.33	.54
	Humor Condition	28	8.21	3.20	6.29	4.29	2.19	.38	2.51	.70
	Neutral Condition	31	6.81	3.10	4.35	2.59	2.08	.38	2.33	.75

Table 15

Overall Model Coefficients for Moderating Effect of Condition on Creativity Outcomes (Study One)

Predictor Variable	Outcome Variable	R	R^2	F	p
Openness to Experience					
	Unusual Uses Fluency	.30	.09	$F(5, 83) = 1.63$	.160
	Product Improvement Fluency	.36	.13	$F(5, 83) = 2.42$	.043
	Unusual Uses Novelty	.27	.07	$F(5, 83) = 1.26$	.290
	Product Improvement Novelty	.17	.03	$F(5, 83) = .49$	.784
Extraversion					
	Unusual Uses Fluency	.44	.19	$F(5, 80) = 3.78$	.004
	Product Improvement Fluency	.37	.14	$F(5, 80) = 2.60$	.031
	Unusual Uses Novelty	.32	.11	$F(5, 80) = 1.88$	.106
	Product Improvement Novelty	.19	.04	$F(5, 80) = .59$	.708

Table 16

Model Coefficients for Extraversion Moderating Effect of

Predictor Variable	*b*	*SE*	*t*	*p*
Extraversion	-.67	.58	$t(80) = -1.16$	.249
W1: Humor vs. Neutral	1.23	1.13	$t(80) = 1.09$	.279
W2: Positive vs. Neutral	3.22	1.14	$t(80) = 2.83$	.006
Extraversion x W1	.06	.84	$t(80) = .08$	.940
Extraversion x W2	2.42	.83	$t(80) = 2.90$	.005

Table 17

Correlations Among Post-Emotion Scale Scores, Divergent Creativity, and Personality Traits (Study One)

Variable Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Post-Happy	1															
2. Post-Amused	.655**	1														
3. Post-Bored	-.529**	-.629**	1													
4. Post-Upset	.563**	-.533**	.641**	1												
5. Post-Confused	-.253	-.092	.291*	.614**	1											
6. Unusual Uses Fluency	-.004	.166	-.232	-.022	-.167	1										
7. Unusual Uses Novelty	-.344*	-.148	-.061	.185	-.020	.519**	1									
8. Product Improvement Fluency	-.181	.104	-.125	-.063	-.126	.657**	.327**	1								
9. Product Improvement Novelty	-.070	.111	.005	.143	.097	.044	.054	-.007	1							
10. Anagrams	-.200	-.112	.144	.302*	.331*	.054	0.061	-.029	.107	1						
11. Remote Associates Test	-.060	-.036	.079	.18	.119	.187	.236*	.166	.119	.344**	1					
12. Extraversion	.076	.012	.244	.044	.032	.012	-.131	.055	.074	.136	.053	1				
13. Agreeableness	.173	.047	-.113	-.083	-.181	.298**	.233*	.220*	-.155	.140	.186	-.102	1			
14. Conscientiousness	.128	-.155	-.037	.021	-.146	.054	.049	-.078	.010	.149	.020	-.018	.325**	1		
15. Neuroticism	.141	-.099	-.028	-.016	-.079	.087	.089	.003	-.145	.210	.090	.132	.463**	.598**	1	
16. Openness to Experience	.108	-.085	.049	-.006	-.269	.101	.089	.170	.019	.082	.138	.097	.308**	.344**	.291**	1

Note. **denotes significance at $p < .01$ (two-tailed); *denotes significance at $p < .05$ (two-tailed).

Table 18

Demographic Information for Participants (Study Two)

Variable Name	*N*	*%*	*M*	*SD*	*Min*	*Max*
Conditions						
Positive	43	23.9%				
Humor	49	27.2%				
Neutral	44	24.4%				
Irony	44	24.4%				
Gender						
Male	65	36.1%				
Female	113	62.8%				
Choose not to answer	2	1.1%				
Age	179		20.47	3.67	17	49
Race						
African-American/Black	26	14.4%				
East Asian/South Asian/Pacific Islander	35	19.4%				
Caucasian/White	41	22.8%				
Hispanic/Latino	68	37.8%				
Middle Eastern/North African/Arab American	4	2.2%				
Choose not to answer	6	3.3%				
English as a first language						
Yes	129	71.7%				
No	51	28.3%				

Table 19

Intercorrelations of Creativity Variables (Study Two)

Variable Name	1	2	3	4	5	6
1. Unusual Uses Fluency	1					
2. Unusual Uses Novelty	.634**	1				
3. Product Improvement Fluency	.486**	.278**	1			
4. Product Improvement Novelty	.295**	.398**	.045	1		
5. Remote Associates Test	.222**	.047	.261**	.075	1	
6. Anagrams	.073	-.002	.051	.010	.180*	1

Note. *denotes significance at $p < .05$ (two-tailed); ** denotes significance at $p < .01$ (two-tailed).

Table 20

Descriptive Statistics from Emotion Scale (Study Two)

	Humor Condition			Irony Condition		
	Post-Measure	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*
Happiness	3.57 (1.08)	3.14 (1.10)	.43*	3.34 (1.18)	3.16 (1.03)	.18*
Amused	3.57 (1.12)	2.57 (1.02)	1.00*	3.55 (1.11)	2.59 (1.19)	.96*
Bored	2.18 (1.05)	3.22 (1.23)	-1.04*	2.52 (1.13)	3.50 (1.07)	-.98*
Upset	1.57 (.74)	1.98 (1.25)	-.41*	1.61 (.84)	2.05 (1.24)	-.44*
Confused	1.71 (.94)	2.04 (1.26)	-.33	1.89 (1.13)	2.05 (1.36)	-.16

Note. Standard deviations in parentheses; $N_{\text{humor}} = 49$, $N_{\text{irony}} = 44$; *denotes significance at $p < .05$ (two-tailed).

Table 21

Descriptive Statistics for Each Creativity Measure (Study Two)

Variable Name	Positive Condition	Humor Condition	Neutral Condition	Irony Condition
Unusual Uses Fluency	9.05 (4.21)	7.69 (3.47)	7.91 (3.48)	6.73 (3.86)
Product Improvement Fluency	7.65 (4.37)	5.65 (3.76)	6.14 (3.11)	6.50 (4.18)
Unusual Uses Novelty	2.10 (.40)	2.00 (.39)	1.96 (.38)	1.87 (.44)
Product Improvement Novelty	2.09 (.67)	2.26 (.80)	2.12 (.58)	2.26 (.81)
Remote Associates Test	5.21 (2.88)	4.94 (3.23)	5.36 (3.08)	4.80 (2.57)
Anagrams	6.35 (4.21)	5.73 (4.05)	6.25 (4.26)	5.20 (4.12)

Note. Standard deviations in parentheses; $N_{positive} = 43$, $N_{humor} = 49$, $N_{neutral} = 44$, $N_{irony} = 44$.

Table 22

Descriptive Statistics for Each Creativity Measure, Separated by Presence of Post-Emotion Measure (Study Two)

	Post-Emotion Scale Absent			Post-Emotion Scale Present		
Variable Name	*Mean*	*SD*	*N*	*Mean*	*SD*	*N*
Unusual Uses Fluency	8.47	3.88	87	7.24	3.67	93
Product Improvement Fluency	6.89	3.84	87	6.05	3.97	93
Unusual Uses Novelty	2.03	.39	87	1.94	.42	93
Product Improvement Novelty	2.11	.62	87	2.26	.80	93
Remote Associates Test	5.29	2.97	87	4.87	2.92	93
Anagrams	6.30	4.21	87	5.48	4.07	93

Table 23

Intercorrelations of Predictors and Outcome Variables (Study Two)

Variable Name	1	2	3	4	5	6	7	8	9
1. Openness	1								
2. Extraversion	.214*	1							
3. Conscientiousness	.202*	-.094	1						
4. Unusual Uses Fluency	.238*	.030	.005	1					
5. Unusual Uses Novelty	.102	-.011	-.043	.634*	1				
6. Product Improvement Fluency	.150*	-.037	.110	.486*	.278*	1			
7. Product Improvement Novelty	.035	-.070	-.097	.295*	.398*	.045	1		
8. Remote Associates Test	.076	-.060	-.012	.222*	.047	.261**	.075	1	
9. Anagrams	.052	.029	.161*	.073	-.002	.051	.010	.180*	1

Note. *denotes significance at $p < .01$ (two-tailed).

Table 24

Overall Model Coefficients for Moderating Effect of Condition on Creativity Outcomes (Study Two)

Predictor Variable	Outcome Variable	R	R^2	F	p
Openness to Experience					
	Unusual Uses Fluency	.31	.10	$F(7, 172) = 2.69$	.011
	Product Improvement Fluency	.26	.07	$F(7, 172) = 1.77$	.097
	Unusual Uses Novelty	.30	.09	$F(7, 172) = 2.45$	.020
	Product Improvement Novelty	.17	.03	$F(7, 172) = .72$	.654
Extraversion					
	Unusual Uses Fluency	.23	.05	$F(7, 172) = 1.40$	.207
	Product Improvement Fluency	.28	.08	$F(7, 172) = 2.15$	.041
	Unusual Uses Novelty	.22	.05	$F(7, 172) = 1.27$	.266
	Product Improvement Novelty	.16	.03	$F(7, 172) = .672$	.696
Conscientiousness					
	Remote Associates Test	.09	.01	$F(7, 172) = .21$	.983
	Anagrams	.26	.07	$F(7, 172) = 1.78$	.094

Table 25

Correlations Among Post-Emotion Scale Scores, Divergent Creativity, and Personality Traits (Study Two)

Variable Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Post-Happy	1															
2. Post-Amused	.756**	1														
3. Post-Bored	-.340**	-.365**	1													
4. Post-Upset	-.386**	-.360**	.254*	1												
5. Post-Confused	-.236*	-.147	.130	.435**	1											
6. Unusual Uses Fluency	-.003	.015	-.163	-.129	-.114	1										
7. Unusual Uses Novelty	.055	.117	-.177	-.250*	-.111	.634**	1									
8. Product Improvement Fluency	-.027	-.019	.031	-.003	.072	.486**	.278**	1								
9. Product Improvement Novelty	.077	.168	-.141	-.122	-.126	.295**	.398**	.045	1							
10. Anagrams	-.090	-.015	.035	.005	.037	.073	-.002	.051	.010	1						
11. Remote Associates Test	.068	-.082	-.067	-.004	-.081	.222**	.047	.261**	.075	.180*	1					
12. Extraversion	.084	.034	.019	-.024	.020	.030	-.011	-.037	-.070	.029	-.060	1				
13. Agreeableness	.018	.100	-.199	-.030	-.055	-.023	-.026	.054	.020	-.057	-.032	-.082	1			
14. Conscientiousness	-.004	.055	.051	-.190	.007	.005	-.043	.110	-.097	.161*	-.012	-.094	.182*	1		
15. Neuroticism	.245*	.164	-.131	-.413**	-.222	.040	.098	-.023	.076	-.102	-.112	.011	.197*	.189*	1	
16. Openness to Experience	.152	.154	-.112	-.112	-.073	.238**	.102	.150*	.035	.052	.076	.214**	.093	.202**	.039	1

Note. **denotes significance at $p < .01$ (two-tailed); *denotes significance at $p < .05$ (two-tailed).

Table 26

Demographic Information for Participants (Study Three)

Variable Name	*N*	%	*M*	*SD*	*Min*	*Max*
Conditions (all)						
Positive	34	12.9%				
Positive Explain	31	11.8%				
Humor	37	14.1%				
Humor Explain	28	10.6%				
Neutral	31	14.1%				
Neutral Explain	31	11.8%				
Irony	31	11.8%				
Irony Explain	34	12.9%				
Conditions (overall)						
Positive	65	24.7%				
Humor	65	24.7%				
Neutral	68	25.9%				
Irony	65	24.7%				
Gender						
Male	91	34.6%				
Female	168	63.9%				
Choose not to answer	4	1.5%				
Age	263		31.94	12.76	18	75
Race						
African-American/Black	16	6.1%				
East Asian/South Asian/Pacific Islander	34	12.9%				
Caucasian/White	187	71.1%				
Hispanic/Latino	21	8.0%				
Native American/Alaskan Native/Indigenous	2	0.8%				
Middle Eastern/North African/Arab American	1	0.4%				
Choose not to answer	2	0.8%				
English as a first language						
Yes	248	94.3%				
No	15	5.7%				

Table 27

Intercorrelations of Creativity Variables (Study Three)

Variable Name	1	2	3	4
1. Unusual Uses Fluency	1			
2. Unusual Uses Novelty	.477*	1		
3. Product Improvement Fluency	.610*	.252*	1	
4. Product Improvement Novelty	.194*	.280*	.048	1

Note. *denotes significance at $p < .01$ (two-tailed).

Table 28

Descriptive Statistics from Emotion Scale Among Overall Conditions (Study Three)

	Positive Condition			Humor Condition		Neutral Condition			Irony Condition		
	Post-Measure	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*
Happiness	3.60 (1.22)	3.33 (1.24)	.27*	3.66 (.76)	.26*	3.11 (.88)	3.24 (.80)	-.14	3.32 (1.12)	3.21 (1.00)	.12
Amused	3.30 (1.21)	2.70 (1.15)	.60*	3.69 (.87)	.94*	2.78 (1.06)	2.57 (1.07)	.22	3.47 (1.19)	2.56 (1.31)	.91*
Bored	1.93 (1.11)	2.23 (1.04)	-.30	2.06 (1.08)	-.46*	2.46 (1.10)	2.51 (1.30)	-.05	2.12 (1.23)	2.76 (1.30)	-.65*
Upset	1.37 (.77)	1.77 (1.10)	-.40*	1.23 (.55)	-.14	1.24 (.50)	1.59 (.87)	-.35*	1.44 (.89)	1.50 (.90)	-.06
Confused	1.27 (.58)	1.43 (.77)	-.17	1.31 (.68)	.09	1.68 (.97)	1.51 (.99)	.16	1.21 (.48)	1.18 (.46)	.03

Note. Standard deviations in parentheses; $N_{positive} = 30$, $N_{humor} = 35$, $N_{neutral} = 37$, $N_{irony} = 34$.

Table 29

Descriptive Statistics from Emotion Scale Within Each Individual Condition (Study Three)

	Positive Condition			Humor Condition			Neutral Condition			Irony Condition		
	Post-Measure	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*
Happiness	3.60 (1.18)	3.40 (1.12)	.20	3.71 (.85)	3.43 (.68)	.28*	3.21 (.79)	3.21 (.71)	.00	3.38 (.65)	3.00 (.71)	.38*
Amused	3.60 (1.24)	2.73 (1.22)	.87*	3.86 (.79)	2.86 (.85)	1.00*	2.79 (1.03)	2.37 (1.01)	.42	3.69 (.95)	2.00 (1.00)	1.69*
Bored	1.93 (1.03)	2.20 (1.01)	-.27	2.05 (.97)	2.48 (1.08)	-.43*	2.84 (1.01)	2.84 (1.34)	.00	2.54 (1.13)	3.62 (.87)	-1.08*
Upset	1.40 (.74)	1.80 (1.21)	-.40*	1.24 (.63)	1.52 (.98)	-.28*	1.26 (.56)	1.84 (.96)	-.58*	1.15 (.38)	1.38 (.77)	-.23
Confused	1.40 (.63)	1.40 (.74)	.00	1.38 (.81)	1.29 (.64)	.09	1.74 (.93)	1.58 (1.02)	.16	1.23 (.44)	1.31 (.63)	-.08
	Positive Explain Condition			Humor Explain Condition			Neutral Explain Condition			Irony Explain Condition		
	Post-Measure	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*	*Post-Measure*	*Pre-Measure*	*Mean Difference*
Happiness	3.60 (1.30)	3.27 (1.39)	.33	3.57 (.65)	3.36 (.75)	.21	3.00 (.97)	3.28 (.83)	-.28	3.29 (1.35)	3.33 (1.16)	-.04
Amused	3.00 (1.13)	2.67 (1.11)	.33	3.43 (.94)	2.57 (1.02)	.86*	2.78 (1.11)	2.78 (1.11)	.00	3.33 (1.32)	2.90 (1.38)	.43
Bored	1.93 (1.22)	2.27 (1.10)	-.34	2.07 (1.27)	2.57 (1.40)	-.50*	2.06 (1.06)	2.17 (1.20)	-.11	1.86 (1.24)	2.24 (1.26)	-.38
Upset	1.33 (.82)	1.73 (1.03)	-.40*	1.21 (.43)	1.14 (.36)	.07	1.22 (.43)	1.33 (.69)	-.11	1.62 (1.07)	1.57 (.98)	.05
Confused	1.13 (.52)	1.47 (.83)	-.34	1.21 (.43)	1.14 (.36)	.07	1.61 (1.04)	1.44 (.98)	.17	1.19 (.51)	1.10 (.30)	.09

Note. Standard deviations in parentheses; $N_{\text{positive}} = 15$, $N_{\text{humor}} = 21$, $N_{\text{neutral}} = 19$, $N_{\text{irony}} = 13$, $N_{\text{positive explain}} = 15$, $N_{\text{humor explain}} = 14$, $N_{\text{neutral explain}} = 18$, $N_{\text{irony explain}} = 21$.

Table 30

Descriptive Statistics for Each Creativity Measure Within Overall Affect Conditions (Study Three)

Variable Name	Positive Condition	Humor Condition	Neutral Condition	Irony Condition
Unusual Uses Fluency	10.66 (5.37)	11.08 (5.12)	10.91 (5.73)	10.72 (4.85)
Product Improvement Fluency	8.98 (4.57)	8.52 (4.77)	8.72 (5.33)	9.45 (5.73)
Unusual Uses Novelty	2.03 (.44)	2.00 (.44)	2.01 (.43)	2.05 (.35)
Product Improvement Novelty	1.98 (.46)	1.94 (.49)	2.03 (.49)	2.05 (.61)

Note. Standard deviations in parentheses; $N_{positive} = 65$, $N_{humor} = 65$, $N_{neutral} = 68$, $N_{irony} = 65$.

Table 31

Descriptive Statistics for Each Creativity Measure Within Each Affect Conditions (Study Three)

Variable Name	Positive Condition	Humor Condition	Neutral Condition	Irony Condition
Unusual Uses Fluency	11.24 (6.30)	11.62 (5.07)	10.57 (5.61)	10.03 (3.72)
Product Improvement Fluency	9.06 (4.14)	8.41 (4.87)	8.19 (4.62)	8.42 (4.88)
Unusual Uses Novelty	2.01 (.47)	2.06 (.44)	2.02 (.39)	2.07 (.37)
Product Improvement Novelty	1.95 (.44)	2.01 (.51)	2.03 (.51)	2.14 (.81)
	Positive Explain	Humor Explain	Neutral Explain	Irony Explain
Unusual Uses Fluency	10.03 (4.13)	10.36 (5.19)	11.32 (5.95)	11.35 (5.67)
Product Improvement Fluency	8.90 (5.06)	8.68 (4.73)	9.35 (6.10)	10.38 (6.34)
Unusual Uses Novelty	2.06 (.41)	1.94 (.43)	2.01 (.48)	2.03 (.34)
Product Improvement Novelty	2.00 (.49)	1.84 (.46)	2.02 (.48)	2.60 (.31)

Note. Standard deviations in parentheses; $N_{\text{positive}} = 34$, $N_{\text{humor}} = 37$, $N_{\text{neutral}} = 37$, $N_{\text{irony}} = 31$, $N_{\text{positive explain}} = 31$, N_{humor}

Table 32

Descriptive Statistics for Each Creativity Measure, Separated by Presence of Post-Emotion Measure

	Post-Emotion Scale Absent			Post-Emotion Scale Present		
Variable Name	*Mean*	*SD*	*N*	*Mean*	*SD*	*N*
Unusual Uses Fluency	10.40	5.29	127	11.26	5.21	136
Product Improvement Fluency	8.39	5.06	127	9.41	5.12	136
Unusual Uses Novelty	1.99	.42	127	2.06	.41	136
Product Improvement Novelty	1.99	.53	127	2.00	.50	136

Table 33

Intercorrelations of Predictors and Outcome Variables (Study Three)

Variable Name	1	2	3	4	5	6	7
1. Openness	1						
2. Extraversion	.357**	1					
3. Conscientiousness	.085	.176**	1				
4. Unusual Uses Fluency	.049	.042	.001	1			
5. Unusual Uses Novelty	.058	-.042	-.016	.477**	1		
6. Product Improvement Fluency	-.021	.126*	-.091	.610**	.252**	1	
7. Product Improvement Novelty	.020	-.096	-.126*	.194**	.280**	.048	1

Note. **denotes significance at $p < .01$ (two-tailed); *denotes significance at $p < .05$ (two-tailed).

Table 34

Overall Model Coefficients for Moderating Effect of Condition on Creativity Outcomes (Study Three)

Predictor Variable	Outcome Variable	R	R^2	F	p
Openness to Experience					
	Unusual Uses Fluency	.07	.01	$F(7, 255) = .19$	.987
	Product Improvement Fluency	.13	.02	$F(7, 255) = .62$	.735
	Unusual Uses Novelty	.12	.02	$F(7, 255) = .56$	.791
	Product Improvement Novelty	.14	.02	$F(7, 255) = .76$	.620
Extraversion					
	Unusual Uses Fluency	.09	.01	$F(7, 255) = .31$	.949
	Product Improvement Fluency	.16	.02	$F(7, 255) = .92$	.494
	Unusual Uses Novelty	.07	.01	$F(7, 255) = .19$	.987
	Product Improvement Novelty	.20	.04	$F(7, 255) = 1.57$	.145

Table 35

Correlations Among Post-Emotion Scale Scores, Divergent Creativity, and Personality Traits (Study Three)

Variable Name	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Post-Happy	1												
2. Post-Amused	.683**	1											
3. Post-Bored	-.332**	-.443**	1										
4. Post-Upset	-.444**	-.327**	.270*	1									
5. Post-Confused	-.220*	-.238**	.314**	.413**	1								
6. Unusual Uses Fluency	-.026	.026	-.096	-.054	-.107	1							
7. Unusual Uses Novelty	-.018	.049	-.027	-.048	-.038	.477**	1						
8. Product Improvement Fluency	-.053	.061	-.021	.013	-.044	.610**	.252**	1					
9. Product Improvement Novelty	.000	.151	-.115	-.075	-.146	.194**	.280**	.048	1				
10. Extraversion	.413**	.258**	-.118	-.286**	-.155	.042	-.042	.126*	-.096	1			
11. Agreeableness	.251**	.109	-.103	-.063	-.049	-.037	-.008	-.017	-.099	.078	1		
12. Conscientiousness	.265**	.203*	-.267**	-.136	-.176*	.001	-.016	-.091	-.126*	.176**	.185**	1	
13. Neuroticism	.379**	.114	-.200*	-.224**	-.160	-.042	.025	-.127*	-.108	.229**	.251**	.412**	1
14. Openness to Experience	.258**	.089	-.125	-.294**	-.003	.049	.058	-.021	.020	.357**	.178**	.085	.117

Note. **denotes significance at $p < .01$ (two-tailed); *denotes significance at $p < .05$ (two-tailed).

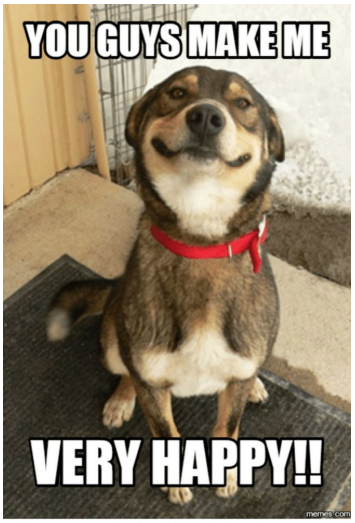
Appendix A

Picture Stimuli

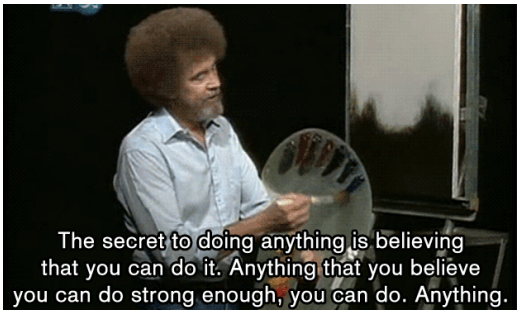
Positive Condition(s)

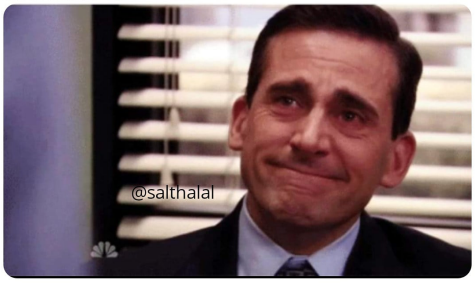
Pokemon Happy

Happy Puppy



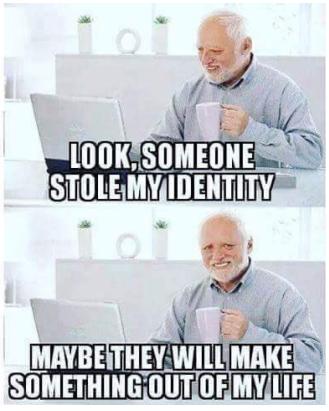
Love

News	
Bob Ross	
Pikachu	
Friends	

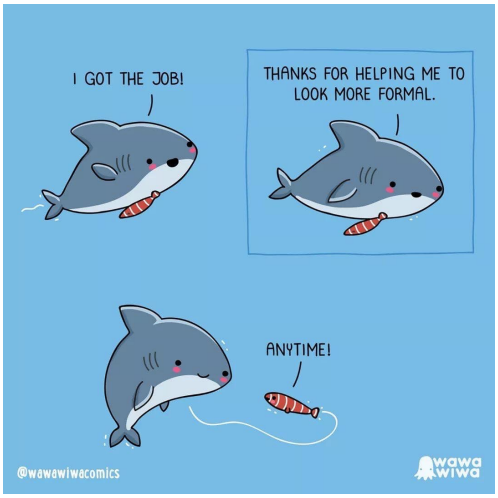
Life	When you realize that this bad phase or slump in your life is not only temporary, and will inevitably pass, But also, that you will come out of this as a stronger, more capable individual. ❤️ 
Dog Parade	if your day is bad always remember this happy little dog who thought this parade was just for him 
Toy Story	Forky. @Sferreira_22 My grandmother took me to see toy story 1,2 and 3. It was my turn 🤷‍♀️ 

Humor Condition(s)

Making Out	Me: *making out with girlfriend on the couch* Her: You wanna take this to the bedroom? Me: Aight I'll grab this end, you get the other 
Brenda	Is this a joke to you Brenda? 
Bee Haw	Texan bees in the spring 

Woofles	
Twelve	
Harold	

Formal

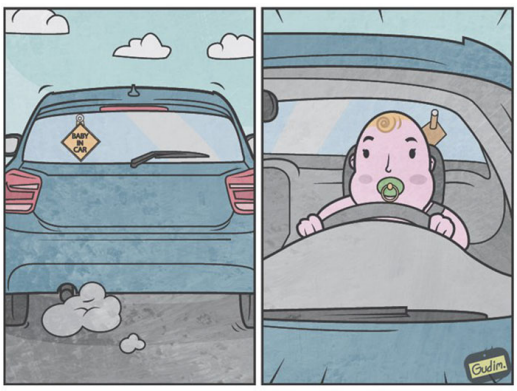


Good Boy

Dad Book

Parents	

Neutral Condition (I)

Insurance	
Baby on Board	

Clever

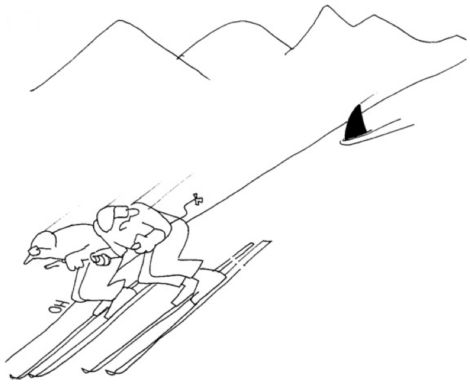
"Son, if you can't say something nice, say something clever but devastating."

Wikipedia

Can Do Bunny

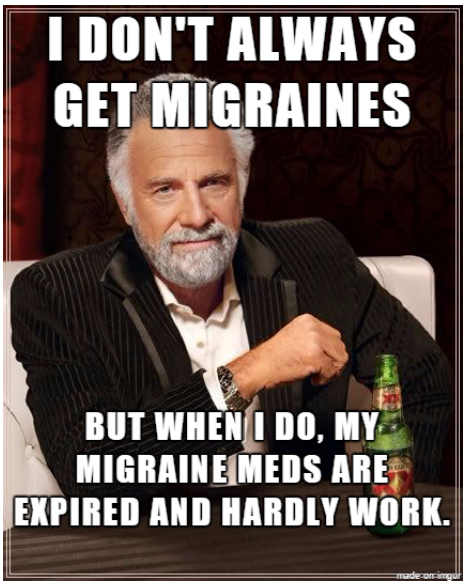
Mosquito

Shark Skiing



Shoes

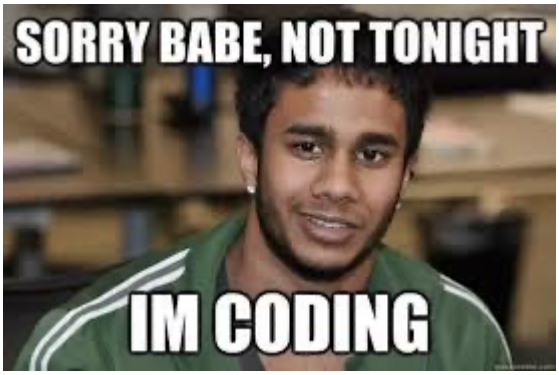
Migraines



Chameleon

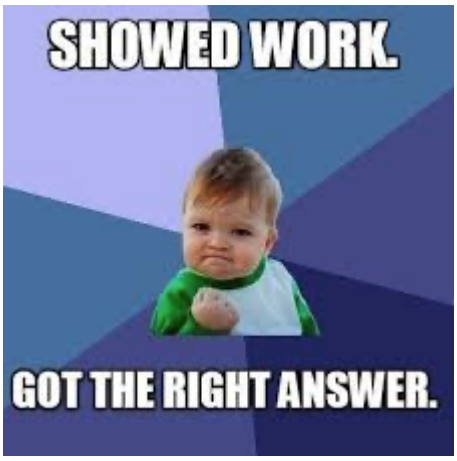
Neutral Condition(s) (II)

Tonight

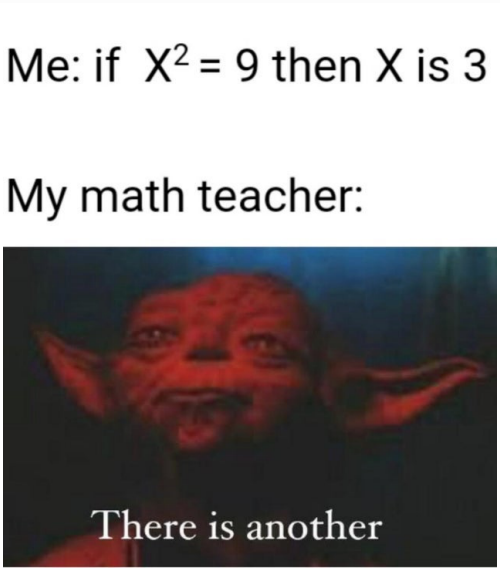


Java

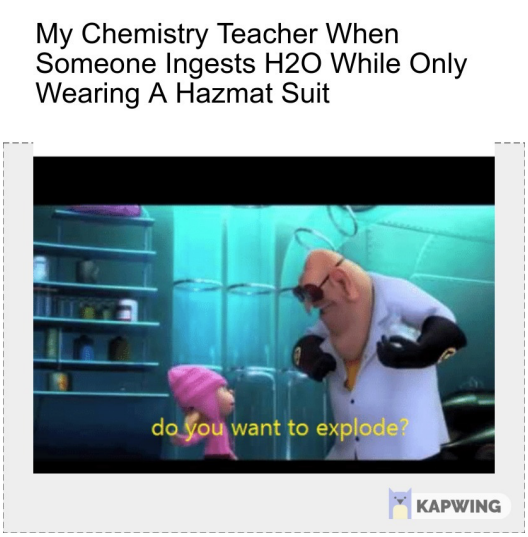
Work



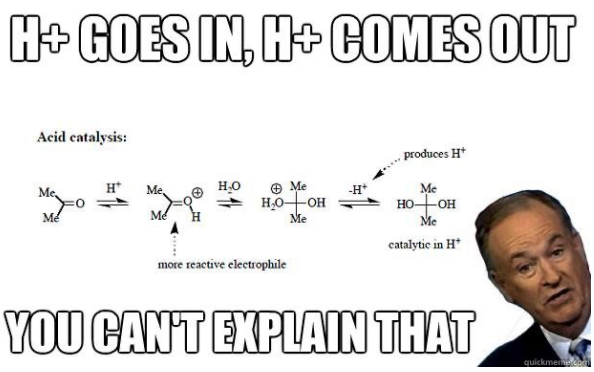
Another



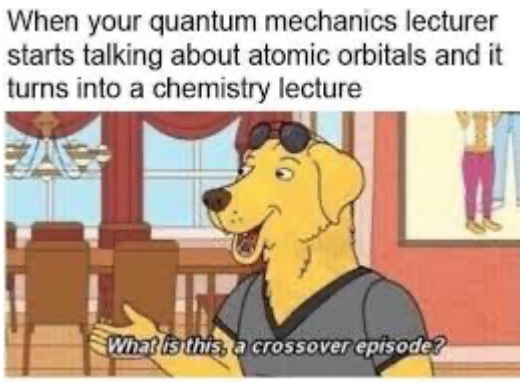
Hazmat



Catalysis



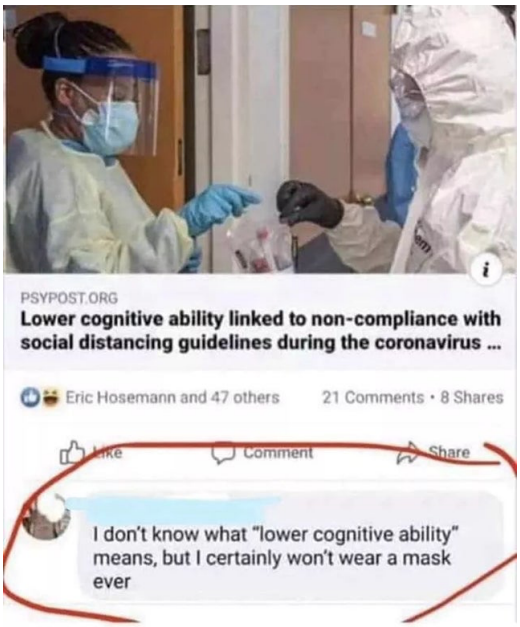
Capacitor

Dilute	
Fascinated	
Quantum	

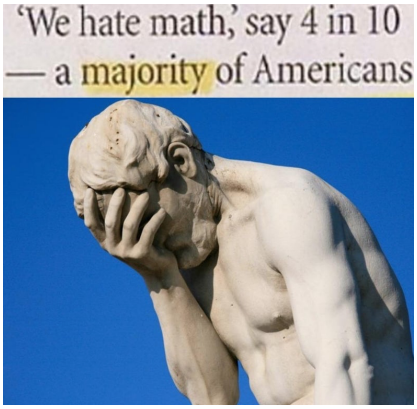
Irony Condition(s)

March

Lower Cognition



Texts

Lit	
Grocery	
Majority	

Minnie

Views

Unpossible

Communication

Appendix B

Individual Difference Measures

Ten-Item Personality Inventory (TIPI; Gosling et al., 2003)

Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
1	2	3	4	5	6	7

I see myself as:

Extraverted, enthusiastic.

Critical, quarrelsome.

Dependable, self-disciplined.

Anxious, easily upset.

Open to new experiences, complex.

Reserved, quiet.

Sympathetic, warm.

Disorganized, careless.

Calm, emotionally stable.

Conventional, uncreative.

Humor Styles Questionnaire (Martin et al., 2003)

People experience and express humor in many different ways.

Below is a list of statements describing different ways in which humor might be experienced.

Please read each statement carefully, and indicate the degree to which you agree or disagree with it.

Please respond as objectively as you can.

Totally disagree	Moderately disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Moderately agree	Totally agree
1	2	3	4	5	6	7

I usually don't laugh or joke around much with other people.

If I am feeling depressed, I can usually cheer myself up with humor.

If someone makes a mistake, I will often tease them about it.

I let people laugh at me or make fun at my expense more than I should.

I don't have to work very hard at making other people laugh - I seem to be a naturally humorous person.

Even when I'm by myself, I'm often amused by the absurdities of life.

People are never offended or hurt by my sense of humor.

I will often get carried away in putting myself down if it makes my family or friends laugh.

I rarely make other people laugh by telling funny stories about myself.

If I am feeling upset or unhappy I usually try to think of something funny about the situation to make myself feel better.

When telling jokes or saying funny things, I am usually not very concerned about how other people are taking it.

I often try to make people like or accept me more by saying something funny about my own weaknesses, blunders, or faults.

I laugh and joke a lot with my closest friends.

My humorous outlook on life keeps me from getting overly upset or depressed about things.

I do not like it when people use humor as a way of criticizing or putting someone down.

I don't often say funny things to put myself down.

I usually don't like to tell jokes or amuse people.

If I'm by myself and I'm feeling unhappy, I make an effort to think of something funny to cheer myself up.

Sometimes I think of something that is so funny that I can't stop myself from saying it, even if it is not appropriate for the situation.

I often go overboard in putting myself down when I am making jokes or trying to be funny.

I enjoy making people laugh.

If I am feeling sad or upset, I usually lose my sense of humor.

I never participate in laughing at others even if all my friends are doing it.

When I am with friends or family, I often seem to be the one that other people make fun of or joke about.

I don't often joke around with my friends.

It is my experience that thinking about some amusing aspect of a situation is often a very effective way of coping with problems.

If I don't like someone, I often use humor or teasing to put them down.

If I am having problems or feeling unhappy, I often cover it up by joking around, so that even my closest friends don't know how I really feel.

I usually can't think of witty things to say when I'm with other people.

I don't need to be with other people to feel amused - I can usually find things to laugh about even when I'm by myself.

Even if something is really funny to me, I will not laugh or joke about it if someone will be offended.

Letting others laugh at me is my way of keeping my friends and family in good spirits.

Pre/Post Emotion Scale

Please select the number on the scale that best describes how you feel <u>at this moment.</u>

	Very slightly or Not at all				Extremely
	1	2	3	4	5
Happy					
Amused					
Bored					
Upset					
Confused					

Unusual Uses Task (Guilford, 1956; 1960)

In the text box below, please list all the uses you can think of for a paperclip.

Hit “Enter” after each idea.

*This page will automatically advance forward once the timer reaches 00:00:00.

Product Improvement Task (Guilford, 1956; 1960)

In the text box below, please list the cleverest, most interesting and unusual ways you can think of to change the toy elephant pictured above so that it is more fun to play with.

Please hit “Enter” after each idea.

*This page will automatically advance forward once the timer reaches 00:00:00.

Remote Associates Test (Mednick, 1962; Huang et al., 2015)

Each of the following questions contains a set of three words.

In the text box corresponding to each question set, please type in the word you believe logically links the three words provided in each question.

For example:

The answer to *manners* / *round* / *tennis* is **table**

The answer to *rocking* / *wheel* / *high* is **chair**

*This page will automatically advance forward once the timer reaches 00:00:00.

blank / white / lines

magic / plush / floor

thread / pine / pain

stop / petty / sneak

envy / golf / beans

chocolate / fortune / tin

barrel / root / belly

broken / clear / eye

pure / blue / fall

widow / bite / monkey

chamber / staff / box

mouse / sharp / blue

hall / car / swimming

square / cardboard / open

ticket / shop / broker

high / book / sour

gold / stool / tender

Anagrams

The following are six-letter anagrams. Your task is to unscramble the letters to create a word.

In the text box corresponding to each set, please enter your responses.

For example, the answer to *VTSIA* would be **VISTA**

*This page will automatically advance forward once the timer reaches 00:00:00.

DIMOSW

SWIJAG

MLSPAE

LYURHO

ADKETN

CKOLRE

DEMPUJ

OGNIRE

IDNTUY

ILEPNC

OSLCRE

ALCYLM

VRISLA

Demographics

How interested were you in the photos that were shown earlier?

Not at all interested	Slightly interested	Neutral	Moderately interested	Very interested

Please enter today's date and current time:

Please select your gender:

Male

Female

Choose not to answer

Please indicate your age (in years):

Please indicate the racial group with which you most identify:

African-American/Black

East Asian/South Asian/Pacific Islander

Caucasian/White

Hispanic/Latino

Native American/Alaskan Native/Indigenous

Middle Eastern/North African/Arab American

Choose not to answer

Is English your first language?

Yes

No

What do you believe the purpose of this study was?

In what order did you complete the problem-solving tasks? If you did not complete a task, please do not assign a number (i.e., leave it blank).

Anagrams

3-Word Associations

Paperclip Task

Elephant Task

What is your NetID (example: abc1234)

Appendix C

Memory Tests

Positive Condition(s)

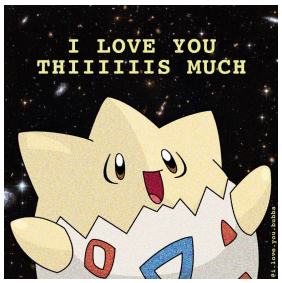
Picture 1

Picture 2

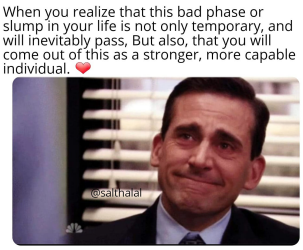
Picture 3

Picture 4

Picture 5



Picture 6



Picture 7

Picture 8

Picture 9

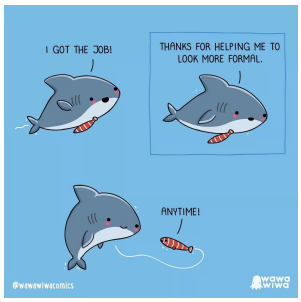
Picture 10

Humor Condition(s)

Picture 1

Picture 2

Picture 3



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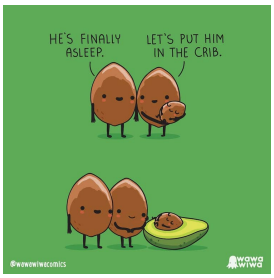

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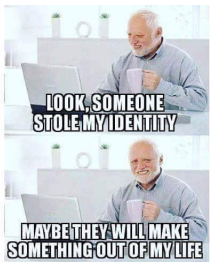


Picture 6

Picture 7

Picture 8

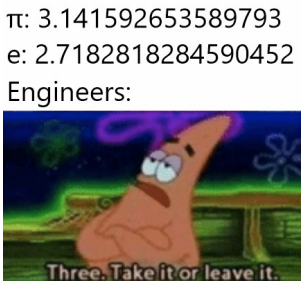
Picture 9

Picture 10

Neutral Condition(s)

Picture 1

Picture 2



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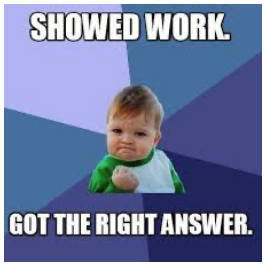

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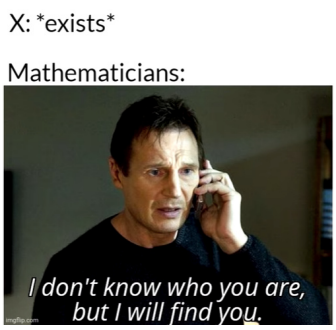
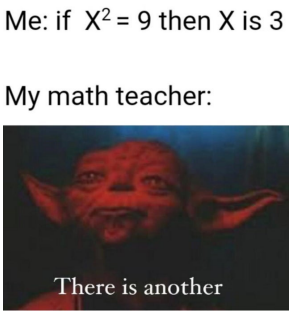


Picture 5

Picture 6

Picture 7



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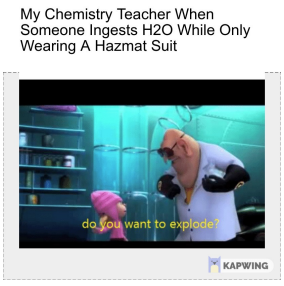

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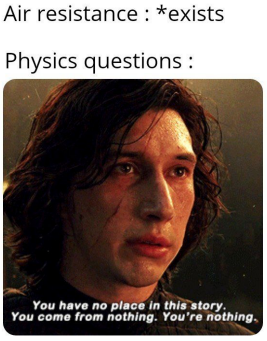

Picture 10

Irony Condition(s)

Picture 1

Picture 2

Picture 3

Picture 4

Picture 5

Picture 6

Picture 7

Picture 8

Picture 9

Picture 10